Performance Specification
Models T25/T50/T80/T200
and T300

NOVEMBER 1980

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-1	Add's New Manual Part Number
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SECTION 1
INTRODUCTION

1.1 PURPOSE

This manual contains the information necessary to interface a TRIDENT disk drive to a controller and ultimately to a computer system. Unless otherwise noted, all information is applicable to all members of the TRIDENT family.

1.2 RELATED DOCUMENTS

Companion Century Data Systems documents on TRIDENT disk drives available include:

T-25/50/80 TRIDENT Theory of Operation Manual
T-200/300 TRIDENT Theory of Operation Manual
T-25/50/80 TRIDENT Installation and Operation Manual
T-200/300 TRIDENT Installation and Operation Manual
T-25/50/80 TRIDENT Maintenance Manual
T-200/300 TRIDENT Maintenance Manual
T-25/50/80 TRIDENT Field Parts Catalog
T-200/300 TRIDENT Field Parts Catalog
T2000B Exerciser Technical Manual

1.3 GENERAL DESCRIPTION

The TRIDENT family of disk drives is a series of low cost, high density, modular disk storage units uniquely suited to the OEM's requirements. Using 3330 technology, they provide 25, 50 or 80 megabytes of storage in a 10½″ high rack-mounted device, and 200 or 300 megabytes of storage in a single spindle console.

Access time is a maximum of 6 ms track-to-track and 55 ms full stroke, with a data transfer rate of 806 or 1209 Kbytes per second.

TRIDENT contains many features which allow the systems designer to incorporate it into his system with a minimum of effort. Among these are self-contained data separator, an attention interrupt, programmable sector length and a variable record length capability.

TRIDENT offers you a third generation replacement for 2314 type drives, expansion capability for cartridge disks and a viable alternative for 3340 disk drives.

1.4 FEATURES

PROGRAMMED HEAD OFFSET allows marginal data to be recovered.

INTEGRAL VFO eliminates all analog circuit design from the controller and synchronizes data recovery circuits to data on the pack.

TRACK FOLLOWING SERVO provides a track alignment reference in the pack, not the drive.

JUMPER SELECTED SECTOR LENGTHS are variable in one or two byte increments.

DYNAMIC SPINDLE BRAKE allows pack changes in less than one minute.

CONTAMINATION CONTROL SYSTEM has enclosed filtered air system for shroud, heads, carriage and linear motor.

SYMMETRICAL CARRIAGE AND WAY allows stresses to pass through the center of mass, eliminating pitch, roll and yaw forces.

RIGID ONE-PIECE DECK PLATE eliminates instability and resonance problems.

CERAMIC VOICE COIL MOTOR reduces external magnetic field and resultant crosstalk problems.

MODULAR CONSTRUCTION so that all major subassemblies are removable as an entity.

INDUSTRY STANDARD SPINDLE INTERFACE allows pack procurement from multiple vendor sources.

FIELD UPGRADABLE FROM 25 to 50, 25 to 80, 50 to 80 and 200 to 300 megabytes.

ADDRESS MARK GENERATION AND DETECTION allows use of variable length records which reduces sector overhead.

DUAL ACCESS FEATURE (optional) allows selective connection to 2 controllers.

SECTION 2
SPECIFICATIONS

2.1 OPERATIONAL SPECIFICATIONS (Nominal)

Table 2-1. Operational Specifications

	T-25	T-50	T-80	T-200	T-300
Bytes per track	13,440	13,440	20,160	13,440	20,160
Tracks per cylinder	5	5	5	19	19
Bytes per cylinder	67,200	67,200	100,800	255,360	383,040
Number of cylinders	408	815	815	815	815
Bytes per pack	27.4M	54.7M	82.1M	208.1 M	312.2 M
Single track positioning time	6 ms	6 ms	6 ms	6 ms	6 ms
Average positioning time	30 ms	30 ms	30 ms	30 ms	30 ms
Maximum positioning time	55 ms	55 ms	55 ms	55 ms	55 ms
Rotational speed	3600 RPM	3600 RPM	3600 RPM	3600 RPM	3600 RPM
Average latency time	8.3 ms	8.3 ms	8.3 ms	8.3 ms	8.3 ms
Recording density	4040 BPI	4040 BPI	6060 BPI	4040 BPI	6060 BPI
Track density	185 TPI	370 TPI	370 TPI	370 TPI	370 TPI
I/O Transfer rate	806 KByte	806 KByte	1209 KByte	806 KByte	1209 KByte
I/O Signal levels	DTL-TTL compatible				
Recording code	MFM — modified frequency modulation				
Interface code (data)	NRZ — none return to zero				
Positioning method	Linear motor track-following servo				
Start time	30 sec.	30 sec.	30 sec.	20 sec.	20 sec.
Stop time	35 sec.	35 sec.	35 sec.	30 sec.	30 sec.

2.2 RELIABILITY

2.2.1 MTBF — Mean Time Between Failures

MTBF is defined as the expected number of operating hours between equipment failures. Operating hours relate to the total "AC Power On" hours less any maintenance time. Equipment failures are defined as malfunctions requiring repairs, adjustments or replacements on an unscheduled basis, i.e., emergency maintenance required because of hardware failure or substandard performance. Excluded is downtime or substandard performance due to operator error, adverse environment, power failure, controller failure, cable failures or malfunctions not caused by the drive.

Following an initial period of 200 operating hours, TRIDENT drives have been designed to exceed an MTBF of 4000 hours, provided the proper preventive maintenance procedures are followed. To establish a meaningful MTBF, operating hours must be greater than 6000 hours and shall include all sites where the drives are used.

2.2.2 MTTR — Mean Time to Repair

MTTR is defined as the time for an adequately trained and competent serviceman to diagnose and correct a malfunction. TRIDENT disk drives are designed so that the MTTR is expected to be less than 1.0 manhours.

2.2.3 Preventive Maintenance Time

Routine scheduled preventive maintenance does not exceed one-half man hour per 1000 hours, based on procedures recommended by Century Data Systems, and performed by suitably trained and competent maintenance personnel.

2.2.4 Service Life

Service Life is defined as the amount of time a product may be economically maintained in the field without a factory overhaul. Since the design of the Trident allows for the field replacement of all major sub-assemblies, a factory overhaul is not required. Therefore, Service Life is not significant in calculating the costs of owning and operating the Trident disk drives.

Key factors affecting the life of the Trident are based on the application and environment. However, in all cases, strict observance of the prescribed preventive maintenance procedures insures maximum service life and performance.

Cost of Ownership

Based on reliability data, an analysis of a Trident in an office environment operating 60 Hr/week with 500 seeks/minute indicated the following; in the first 10 years of operation there is less than a 25% likelihood that any major mechanical sub-assembly will require replacement. These replacements would all be accomplished at the operating site by trained service technicians.

2.2.5 Power Loss

Accidental loss of AC power does not result in any component failure. The drive will retract the heads from the disk pack to ensure that the recording surfaces are not damaged in the event of AC power loss.

2.3 DATA INTEGRITY

Errors attributed to operator mishandling of the data pack or errors in the pack which may be detected and flagged during initialization of the pack are not included in determining error rates.

2.3.1 Recoverable Read Error Rate

A recoverable error is one which may be corrected by no more than 3 attempts to read the record at zero offset and nominal strobe, and 2 attempts to read at each offset position with early, nominal and late strobes (19 reads, see Figure 5-15, Error Recovery). Any combination of Seek-Write, Seek-Read, Seek-Restore is allowed without limitation of combination or duty cycle. Data patterns and track position do not affect Data Error Rate performance. The Recoverable Read Error Rate for TRIDENT is less than one error in 10^{10} bits.

2.3.2 Non-Recoverable Read Error Rate

A non-recoverable error is one which remains after the 19 attempts (described above) to read the record in which the error is located. The Non-Recoverable Data Error Rate for TRIDENT is less than one error in 10^{13} bits.

2.3.3 Positioning Errors

The Positioning Error Rate is less than one error in 10^6 Seek executions.

2.4 MEDIA

Only media from an approved Century Data Systems vendor may be used to determine reliability and integrity numbers. A list of approved vendors may be obtained from any Century Data Systems office.

SECTION 3
FORMAT REQUIREMENTS

3.1 GENERAL

To ensure interchangeability between like disk drives and guarantee proper operation over the entire temperature range, any disk drive must have a preamble and postamble associated with each record. These overhead fields provide compensation for mechanical tolerance, amplifier switching times, VFO capture time and allow for synchronization patterns. The size of each of these fields is dependent upon the tolerances, the bit packing density, and the rotational speed of the drive.

TRIDENT offers the user a choice of formatting schemes. Either electronic sectoring or address mark sectoring may be used for fixed length records. Address mark sectoring must be used for variable length records.

The format requirements outlined in this document are based on a maximum controller "turn-around" delay time of 300 ns and drive-to-controller, one way cable delay of 20 ns minimum to 200 ns maximum.

3.2 ELECTRONIC SECTORING

Electronic sectoring derives the sector and index pulses from the dibits recorded on the servo track. The index pulse occurs once per revolution and is available on the IIDX line in the bussed cable. The number of sector pulses is variable from 1 to 4096. They are available on the ISECTOR line in the bussed cable. In addition, there is an ungated composite sector index pulse (ICOMPSECIDX) which may be used for Rotational Positioning Sensing if needed.

Figure 3-1 illustrates the component parts of this format and the minumum size of each area.

3.2.1 Format A:

Format A is the typical format used in most sector pulse oriented applications. The sector ID field remains unchanged and is not rewritten when the data field is updated.

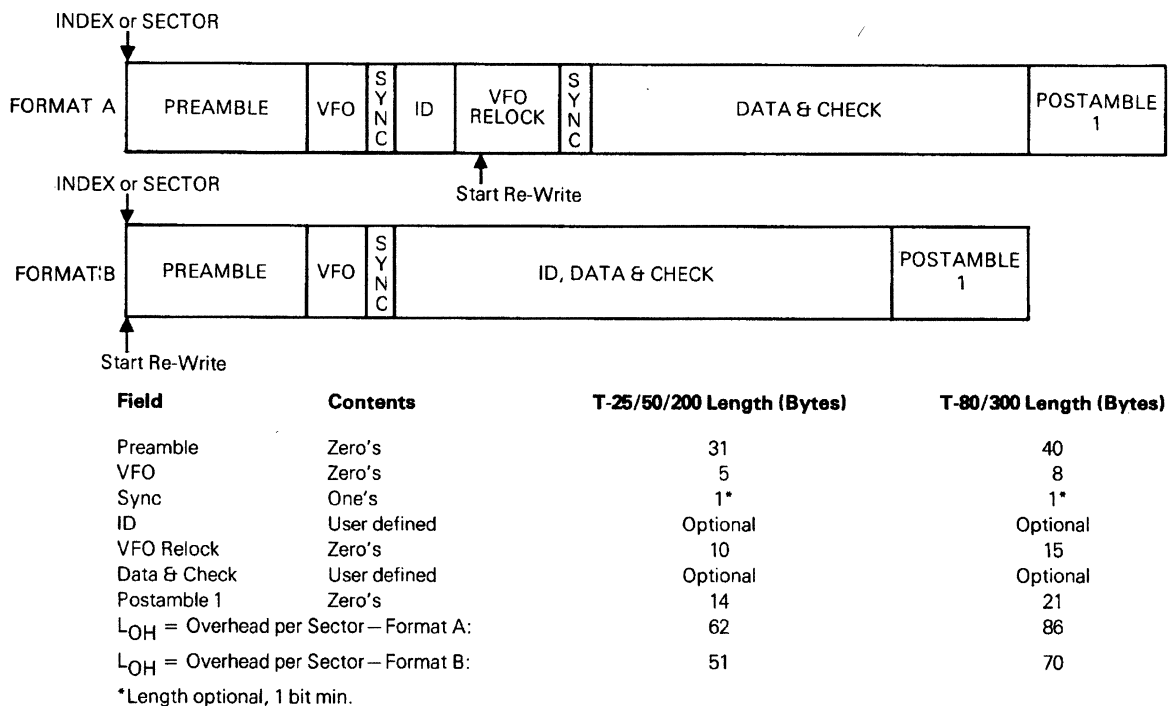| Field	Contents	T-25/50/200 Length (Bytes)	T-80/300 Length (Bytes)
Preamble	Zero's	31	40
VFO	Zero's	5	8
Sync	One's	1*	1*
ID	User defined	Optional	Optional
VFO Relock	Zero's	10	15
Data & Check	User defined	Optional	Optional
Postamble 1	Zero's	14	21
L_{OH} = Overhead per Sector — Format A:		62	86
L_{OH} = Overhead per Sector — Format B:		51	70

*Length optional, 1 bit min.

Figure 3-1. Electronic Sectoring Formats

L_{OH} is 62 bytes for the T-25/50/200 and is 86 bytes for the T-80/300 (Format A). L_{ID} is a system design parameter. It typically contains the cylinder, track and sector address, flags and check character. L_D is also a system parameter and contains both the data field and check character field. Once L_{ID} and L_D are decided upon, they are added to the appropriate L_{OH} to determine the total byte count of each sector. This number is then strapped into the sector jumper plugs as outlined in the TRIDENT Installation and Operation Manual.

3.2.2 Format B:

Some system applications call for the rewriting of the sector ID every time the data field is updated. If this is the case, the ID field can be considered as part of the data field and the VFO relock and second Sync field may be eliminated.

The formula for the maximum number of sectors per track for a given sector size is as follows:

$$n_{max} = \frac{\text{Track Length}}{L_{OH} + L_{ID} + L_D}$$

n_{max} = maximum number of sectors

Track Length = 13440 bytes for the T-25/T-50/T-200
20160 bytes for the T-80/T-300

L_{OH} = length of overhead field l

L_{ID} = length of sector ID

L_D = length of sector data field

3.3 ADDRESS MARK SECTORING

Address Mark Sectoring derives its reference from special patterns recorded on the data track. Since the tolerances between the servo head and the data heads are eliminated, the overhead is reduced and the net system capacity increases.

TRIDENT contains the necessary logic to generate and detect address marks. An I/O command generates the address marks. Another I/O command causes the drive to search for address marks. When one is detected, the Address Mark Detected signal is generated.

Although the sector pulses from the servo surfaces are not used, it is often desirable to use the index marker to gain initial orientation. The index pulse is also a convenient means of denoting the end of a track in a multi-track read or write operation and can initiate the head advance signal to continue the operation.

Address Mark sectoring for sequential read/write operations is illustrated in Figure 3-2.

3.3.1 Format C:

This format is the most common one used in address mark oriented applications. The sector ID field remains unchanged and is not rewritten when the data field is updated. Adjacent sectors can be processed consecutively.

3.3.2 Format D:

If the application calls for rewriting the sector ID field every time the data field is updated, the ID field can be considered as part of the data field and the VFO and first Sync field may be eliminated. Adjacent sectors can be processed consecutively.

3.3.3 Format E:

If the system design is such that adjacent records are never processed consecutively, further economy can be achieved. Address mark formats designed for interlaced records are illustrated in Figure 3-3.

Format E is designed for AM applications without the requirement of processing consecutive sectors.

3.3.4 Format F:

If the ID field needs to be updated every time the data field is rewritten, further economy can be achieved by considering the ID field as part of the data field. The VFO and first Sync field may be eliminated.

3.4 TRACK ID FIELD

Certain AM applications call for a Track Header with a Track ID field at the beginning of each track. The use of such a track header is optional and details are outlined in Figure 3-4.

The formula for the maximum number of sectors per track for a given record size using Address Marks is:

$$n_{max} = \frac{\text{Track Length} - (\text{Track Overhead} + \text{Track Header})}{L_{OH} + L_{ID} + L_D}$$

n_{max} = Maximum number of sectors

Track Length = 13440 for the T-25/50/200
20160 for the T-80/300

Track Overhead = Format dependent

Track Header = Optional

L_{OH} = length of overhead field

L_{ID} = length of sector ID

L_D = length of sector data field

FORMAT C
INDEX

| INDEX PREAMBLE | AM | VFO | SYNC | ID | VFO RELOCK 1 | SYNC | DATA & CHECK | POSTAMBLE 2 | AM | VFO | SYNC | ID | VFO RELOCK 1 | SYNC | DATA | & CHECK | POSTAMBLE 2 |

Start Re-Write Start Re-Write INDEX

FORMAT D
INDEX

| INDEX PREAMBLE | AM | VFO RELOCK 2 | SYNC | ID, DATA & CHECK | POSTAMBLE 2 | AM | VFO RELOCK 2 | SYNC | ID, DATA | & CHECK | POSTAMBLE 2 |

Start Re-Write Start Re-Write

Field	Contents	T-25/50/200 Length (Bytes)	T-80/300 Length (Bytes)
Index Preamble	Zero's	22	34
AM	Erasure	3	3
VFO	Zero's	5	8
Sync	One's	1*	1*
ID	User defined	Optional	Optional
VFO Relock 1	Zero's	10	15
VFO Relock 2	Zero's	11	16
Data & Check	User defined	Optional	Optional
ID, Data & Check	User defined	Optional	Optional
Postamble 2	Zero's	27	28
L_{OH} = Overhead per Sector — Format C:		47	56
L_{OH} = Overhead per Sector — Format D:		42	48
Track Overhead — Format C & D:		22	34

*Length optional, 1 bit min.

Figure 3-2. Addess Mark Formats Sequential Records
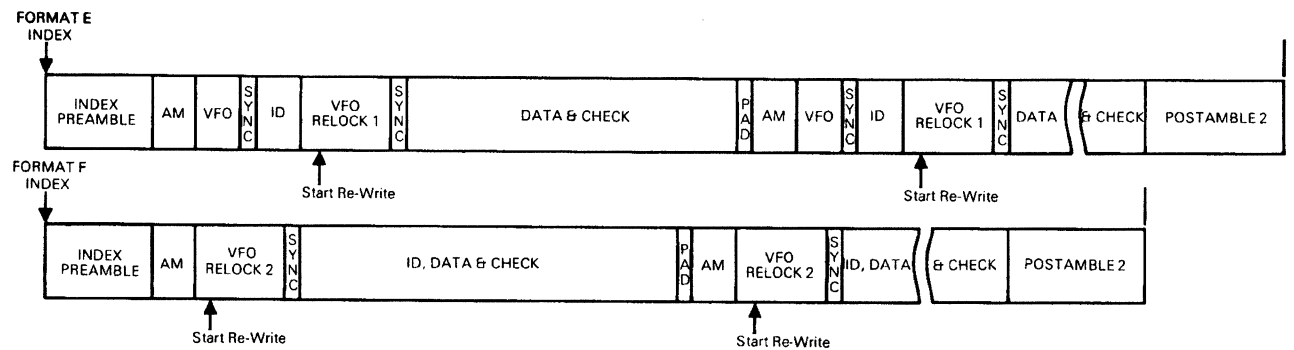
FORMAT E
INDEX

| INDEX PREAMBLE | AM | VFO | SYNC | ID | VFO RELOCK 1 | SYNC | DATA & CHECK | PAD | AM | VFO | SYNC | ID | VFO RELOCK 1 | SYNC | DATA | & CHECK | POSTAMBLE 2 |

Start Re-Write Start Re-Write

FORMAT F
INDEX

| INDEX PREAMBLE | AM | VFO RELOCK 2 | SYNC | ID, DATA & CHECK | PAD | AM | VFO RELOCK 2 | SYNC | ID, DATA | & CHECK | POSTAMBLE 2 |

Start Re-Write Start Re-Write

Field	Contents	T-25/50/200 Length (Bytes)	T-80/300 Length (Bytes)
Index Preamble	Zero's	22	34
AM	Erasure	3	3
VFO	Zero's	5	8
Sync	Zero's	1*	1*
ID	User defined	Optional	Optional
VFO Relock 1	Zero's	10	15
VFO Relock 2	Zero's	11	16
Data & Check	User defined	Optional	Optional
ID, Data & Check	User defined	Optional	Optional
PAD	Zero's	4	4
Postamble 2	Zero's	27	28
L_{OH} = Overhead per Sector — Format E:		24	32
L_{OH} = Overhead per Sector — Format F:		19	24
Track Overhead — Format E & F:		49	62

*Length optional, 1 bit min.

Figure 3-3. Address Mark Formats Interlaced Records

INDEX

Field	Contents	T-25/50/200 Length (Bytes)	T-80/300 Length (Bytes)
Index Preamble	Zero's	22	34
AM	Erasure	3	3
VFO	Zero's	5	8
Sync	One's	1*	1*
Track ID	User defined	Optional	Optional
PAD	Zero's	4	4

*Length optional, 1 bit min.
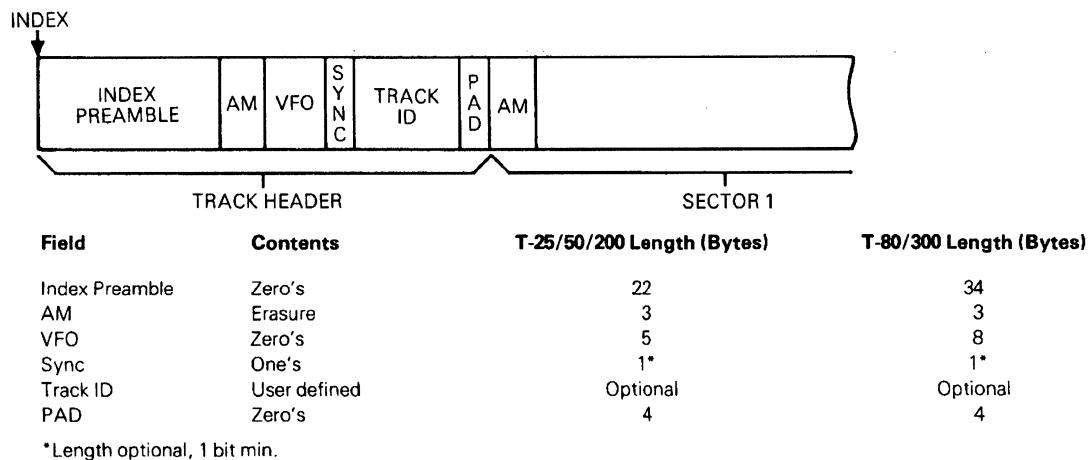
Figure 3-4. Track Header Format

SECTION 4
INTERFACE SIGNALS

4.1 RADIAL CABLE

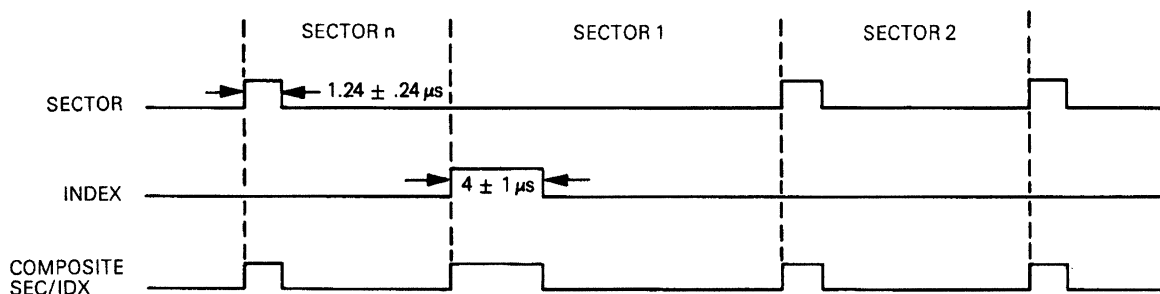| Signal Name	Mnemonic	Input/Output	Description
Select	ISELECT/	I	A low level on this line selects this drive when the terminator is present and the drive is not degated. The drive must be selected at least 200 ns before any bus lines are active.
Selected	ISELECTED/	O	When low, this signal indicates the drive is selected. It goes low within 100 ns of Select.
Sequence	ISEQUENCE/	I	A low level on this signal indicates the sequence cycle. If the START switch is on, this signal will control the spindle motor. It should be removed at least one second before controller DC is removed. When the dual access feature is installed, "Sequence" from either control unit will initiate a power up sequence. The drive will not sequence down until both sequencing signals are removed.
Attention	IATTN/	O	When low, the drive has an interrupt active. It will become active at the completion of a "First Seek", "Rezero", "Seek", "Offset Motion", "No Motion Seek", "Seek Incomplete", or when an emergency retract occurs. When the dual access feature is installed, attention will be sent to the access which is connected to the disk drive. Attention is reset by a read command. In addition, a seek command or a rezero will reset attention in the T-200/300.
DC Ground	None	—	This wire is the DC Ground Reference for the drive. (Number 8 wire should be used.)
Composite Sector/Index	ICOMPSECIDX/	O	This line transmits negative going pulses at both sector and index times. The sector pulses are 1.24 ± .24 μs wide and the index pulses are 4 ± 1 μs wide. This signal is not gated with select. It is intended to be used as an input for rotational position sensing circuits (See Figure 4-1).
Termination Power	ICNTLRP5	I	This line supplies +5 VDC from the control unit and is used to terminate "SELECTED", "ATTENTION" and "COMPOSITE SECTOR/INDEX" in each drive. It is also used to terminate the bussed interface in the last unit. The current required is 150 ma per drive plus 1.25A for the bussed interface, worst case.

Figure 4-1. Composite Sector/Index Signal

Signal Name	Mnemonic	Input/Output	Description
Data	R/W DATA	I/O	When writing, the NRZ write data is transmitted on this line. When reading, the NRZ read data is carried on this line. (See Figure 4-2.)
Clock	R/W CLOCK	O	When writing, this signal is derived from the servo track on the disk pack. As "Write Clock" it is used to strobe data from the controller. The data shall change only at the rising edge of the square wave (measured at the controller). When "Read Gate" is active, the clock source is switched and synchronized to the data being read from the disk pack. "Read Clock" is also a square wave signal. Data will change within 10 ns of the falling edge of the clock (measured at the drive). (See Figure 4-2.)
Request (Dual Access Only)	A REQUEST/ B REQUEST/	I	The request line is activated by the control unit whenever access to the disk drive is desired and remains active as long as continued use of the drive is required. Clearing request allows use of the drive by the other control unit. Note: Low level active.
Request From Other C.U. (Dual Access Only)	A REQ FM B/ B REQ FM A/	O	A signal over this line indicates the other control unit is requesting access to the drive. This signal may be used when both control units are dynamically sharing a drive under automatic control. Note: Low level active.
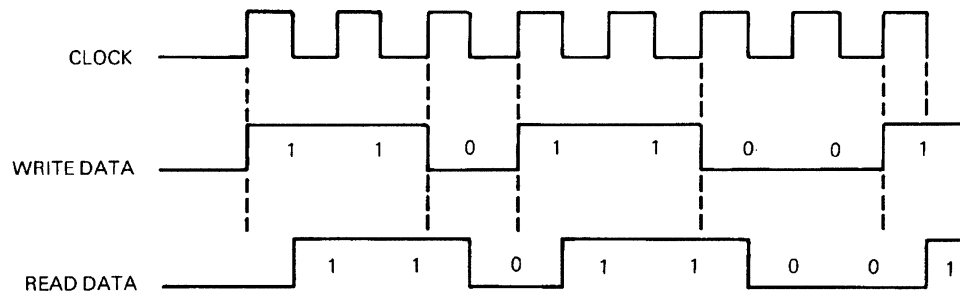
Figure 4-2. Read/Write Timing

4.2 BUSSED CABLE

Signal Name	Mnemonic	Input/Output	Description
Bus 0→Bus 9	IBUS 0/→IBUS9/	I	The 10 bus lines are interpreted according to the current active tag. The drive must be selected at least 200 ns before any bus lines are active. The bus lines must be active at least 200 ns before the tag line and 200 ns after the tag line. All tag lines must be active at least 800 ns.
End of Cylinder	IEOC/	O	This line when low indicates the contents of the head address register are greater than four (T-25/50/80) or 18 (T-200/300).
Offset	IOFFSET/	O	This line when low indicates that the heads are offset. A write operation during offset mode will result in a device check.
Ready	IRDY/	O	This line is low when the heads are loaded and a seek command or offset command are not in progress.
Online	IONLINE/	O	This line is low when the heads are loaded.
Index	IIDX/	O	This line indicates the beginning of a track. It is a 4 $\pm$ 1 μs low going pulse.

Signal Name	Mnemonic	Input/Output	Description
Read Only	IRDONLY/	O	This line when low indicates the read only switch is in the read only position. No write command will be executed. It changes state only when the drive is not selected, or a rezero command is issued.
Seek Incomplete	ISKINC/	O	This line goes low if the last motion command (seek, rezero, first seek) is not completed within 945 ms. It is reset by a Rezero command or by manually restarting the drive.
Set Cylinder Tag	ISETCYLTAG/	I	When this line is low, the bus lines are decoded as the next cylinder address. The trailing edge of ISETCYLTAG is the command to move the heads to the new address. ISETCYLTAG must not be issued if the drive is not ready or offset is active. If a device check occurs when ISET-CYLTAG is issued, a rezero must be issued to reset Device Check.
Set Head Tag	ISETHDTAG/	I	When this line is low, the data bus is interpreted as Head Address and/or Offset Command. It must not be issued if the drive is not ready. If an Offset Command is issued, the drive will be not ready for 2.4 ms from the trailing edge of ISETHDTAG. To reset the selected offset mode, set head tag must be reissued with bus 2 inactive or by the issuance of the REZERO command.
Control Tag	ICONTROLTAG/	I	When this line is low, control information is on the Bus. (See Table 4-1.)

NOTE

The tag lines must be active for at least 800 ns.
There shall only be one tag line active at any given time. 400 ns must separate tag signals.

Sector	ISECTOR/	O	This line represents 1.24 $\pm$ .24 μs low going sector pulses pulses generated with respect to index. The number of sector pulses activated per revolution depend upon programmable jumpers located on the control logic board inside the drive.
Device Check	IDEVCK/	O	When low, this line indicates that at least one of the error conditions in the drive is active. All error conditions in the drive are latched for fault isolation. The error conditions are as follows: a. SETCYLTAG, SETHDTAG or write and not ready. b. An illegal cylinder address. c. Offset active and SETCYLTAG. d. Offset active and write. e. Read only and write. f. Writing and no write current or no transitions detected. g. Write and the servo detects the heads are offtrack. h. Write current and not writing. i. Reading or writing with no head selected or multiple heads selected. This line is reset by the Device Check Reset command except for conditions a*, b + c. These conditions are reset only by a Rezero command. *Only "SETCYLTHG and not ready" portion of "a".

Signal Name	Mnemonic	Input/Output		Description

NOTE

The preceding 9 output signals are gated with select and will be active within 200 ns of the leading edge of select.

Terminator In	ITERIN/	I	This line is low when all of the cables between this drive and the terminator are present and the terminator is present. (Not gated with select.)
Address Mark Detected	IADDMKDET/	O	When an address mark is detected, a low going pulse appears on this line. This signal is only presented, if the address mark signal is activated prior to the address mark on the disk.

4.3 BUS INTERPRETATION

The bus lines are interpreted according to Table 4-1.

Table 4-1. Bus Definitions

	SETCYLTAG	SETHEADTAG	CONTROLTAG
Bus 0	CAR512		Strobe late
Bus 1	CAR256		Strobe early
Bus 2	CAR128	OFFSET	Write
Bus 3	CAR064	OSFWD	Read
Bus 4	CAR032		ADDMK
Bus 5	CAR 016	HAR 16*	HST* R
Bus 6	CAR008	HAR 8*	DEVCKRST
Bus 7	CAR004	HAR 4	HDSEL
Bus 8	CAR002	HAR 2	REZERO
Bus 9	CAR001	HAR 1	HDADV

*T-200/300 only.

4.3.1 Set Cylinder Tag

Bus lines 0-9 are defined as cylinder address. Bus 9 is the LSB.

4.3.2 Set Head Tag

Bus lines 5-9 are defined as head address. Bus 9 is the LSB. Bus 2 is the offset command. It may be issued during a Read operation to recover marginal data. If Bus 3 is also active when Offset is commanded, Offset will be in the forward direction (toward the spindle). If Bus 3 is not active Offset will be in the reverse direction. Offset is reset by issuing this command with Bus 2 inactive or by a Rezero command.

4.3.3 Control Tag

Bus 9 Head Advance	This bit will advance the head address by one.
Bus 8 Rezero	This bit will reposition the heads to cylinder zero if the heads are loaded on the disk. Rezero will reset "seek incomplete" or the error condition caused by an illegal cylinder address or offset/not ready and SETCYLTAG. Rezero will also reset the head address register to "ZERO" and reset offset.
Bus 7 Head Select	This bit turns on the head selection circuits. This bit must be on at least 20 μs for the T-25/50/200 and 15 μs for the T-80/300 before Read or 5 μs before Write is active.
Bus 6 Device Check Reset	This bit will reset all error conditions in the drive which do not have active inputs with the exception of error conditions detected during a set cylinder tag or an emergency retract operation.
Bus 5 Reset Head Register	This bit will reset the head address register to zero.
Bus 4 Address Mark	This bit tells the drive, when reading, to enable the address mark detector or, when writing, to write an address mark. During a read operation this bit must be reset within 1 byte of the leading edge of the "Address Mark Detected" status signal presented to the control unit.
Bus 3 Read	This bit will turn on the read circuits and reset all interrupts.
Bus 2 Write	This bit turns on the write circuits.
Bus 1 Strobe early	This bit will shift the data strobe early with respect to its nominal position in the data window.

Bus 0 Strobe late: This bit will shift the data strobe late with respect to its nominal position in the data window.

4.4 DUAL ACCESS

4.4.1 Description

The Dual Access feature contains the interface and control electronics that allow a single drive or a group of drives to be selectively connected to two control units. The interface electronics provide separate line receivers and line drivers for each control unit. The control electronics implement a "Hardware Interlock" allowing only one control unit to be connected to a drive at any one time. The logical state of the interlock, controlled either by manual switches or control unit selection, assures that an operation is started and completed on a drive without interference from the second control unit. Once a control unit is connected through the dual access interface, all common disk operations are allowed as specified for the standard drive. When a control unit is not connected to a drive through the dual access, all drive commands are ignored.

4.4.2 Configuration

The operator available access switches on the control panel provide separate enable switches for each access. The switches are used to configure which control Unit(s) can access the drive. Internally, each access can be forced to be connected to its associated control unit or completely disabled. With both switches enabled, the drive is configured for automatic operation and connection can be made by either control unit. Table 4-2 lists the configurations established from the four functional states of the two switches.

Table 4-2. Dual Access Switch Configurations

State	Access A	Access B	Configuration
1	ON	ON	Automatic
2	ON	OFF	Manual (Forced Connection to A)
3	OFF	ON	Manual (Forced Connection to B)
4	OFF	OFF	Degated

4.4.3 Functional Operation

If two control units are dynamically sharing a disk drive through automatic control, operation is controlled by the control unit request signals, the operator enable switches, and the failsafe timer. The operation of the operator switches overrides the other controls. A control unit becomes connected under the following conditions:

1. One request signal is asserted and the other access request signal is reset. This is the normal mechanism.

2. One request signal is asserted and the other access has been disconnected due to a time out condition. This is the failsafe mechanism.

In both of the above cases, an attention interrupt will occur when a control unit becomes connected. In addition an interrupt will be generated as specified by the standard interface as long as the access is connected.

The following mechanisms could be used to establish the current state of the dual access interlock:

A control unit asserts its request line whenever access is desired. It then selects the drive and checks for the online status. If the drive is being used by the other control unit or if the operator does not have a pack mounted, the drive would indicate offline. The control unit would then deselect the drive and wait for an attention interrupt. The interrupt would occur when the control unit was connected to the drive. Once a control unit is connected, it would keep its request signal asserted as long as the drive is required. An alternate approach would be once access is requested, the control unit and system software could monitor the request signal from the other control unit and the attention line. The other control unit request line active and the absence of an attention interrupt could identify a busy condition. Under normal operation the drive should never be disconnected in a not ready state. This could result in a double interrupt to a requesting control unit not yet connected. Once connected to a drive, a control unit should always examine the ready status before beginning another operation.

The drives' response of the selected line ensures a control unit that the operator enable switch has not been placed to the "Off" position.

4.4.4 Failsafe Timer

A control unit retains access to a drive once access is granted until it deactivates the request line or until 10 seconds have elapsed with no activity (no tag line activity) and with the other control unit requesting access. For example, if the control unit, C.U.B., has requested access while the drive is connected to C.U.A., the drive

would assert the "Request From Other Control Unit" line to C.U.A., indicating that C.U.B. has requested access to the drive. Simultaneously, the failsafe timer is started to monitor activity of C.U.A. tag lines. C.U.A. must reset the timer (i.e., by pulsing one of the three drive tag lines) before the timer times out; otherwise, the drive will disconnect from C.U.A. without further notice. C.U.B. is now connected to the drive and

the time out condition for C.U.A. reset. In all cases the control units shall be responsible to maintain an activity level within the limit specified by the timer.

NOTE: The 10 second time delay is the nominal time delay provided on all drives. The time delay is jumper-selectable from 670 ms to 39 sec.

SECTION 5
INTERFACE DESCRIPTION

5.1 GENERAL

The controller interface functions may be divided into five areas:

Power Sequencing
Positioning
Data Handling
Error Correction
Diagnostic Aids

5.2 POWER SEQUENCING

The Power On and Power Off sequences are illustrated in Figure 5.1. The SEQUENCE signal affords the controller the opportunity to control the sequencing of each drive in a multiple drive system. If the controller does not use this signal, the spindle should be controlled by the Start/Stop switch on the front panel rather than the system power switch. When the Power On sequence is complete, the heads are positioned at cylinder zero and any command may be given once the drive is ready. Power should not be removed until one second after the Sequence signal is removed or the front panel switch is placed in the Stop position. In the event of a power failure, writing is inhibited and the heads are retracted to prevent media damage.

5.3 POSITIONING

The positioning logic moves the heads to the desired cylinder and selects the proper track. The sequence is illustrated in Figure 5-2. During the time that the actuator is moving, the READY signal goes inactive. At the end of a seek, READY becomes active and ATTENTION is set. ATTENTION is then reset by the next READ command, seek start or rezero.

If the seek is not finished in 945 ms, the Seek Incomplete flag is set. If an illegal cylinder address is given or the offset is active during a seek initialization, Device Check is set. If either of these conditions occur, a Rezero command must be given to clear the fault and re-establish a reference point.

5.4 DATA HANDLING

Before writing on a new pack, the pack must be formatted. A format from Section 3 must be selected and the sector size decided upon. Figures 5-3, 5-4, and 5-5 illustrates this procedure. Figures 5-6 through 5-14 illustrate reading and writing using both electronic and address mark sectoring.

5.5 ERROR CORRECTION

Two methods for recovering temporary errors are provided. The heads may be positioned slightly off-track in either direction and the data may be strobed early or late. Once an error is detected, two additional attempts should be made to read the record at zero offset and nominal strobe. The strobe should then be varied at zero offset and at each offset position. Figure 5-15 illustrates this sequence and the number of repetitions at each point. If the error cannot be corrected by this procedure, it is considered a permanent error.

5.6 DEVICE CHECK

The following conditions are illegal and will set the device check flag:

Set head tag while not ready
Writing while not ready
Writing with offset active
Writing with Read Only active
Writing and off track for any reason
Writing and no heads or multiple heads selected
Writing and no current transitions detected
Writing and write current incorrect
Write current and not writing
Offset and set cylinder tag
Illegal cylinder address
Set cylinder tag while not ready

All but the last three are reset by Device check Reset. They are reset by Rezero only. Rezero also resets the first condition.

5.7 RECOVERY TIMES

a) Head select must be active at least 20 μs for the T-25/50/200 and 15 μs for the T-80/300 before the read and 5 μs before the write gate signal.

b) Switching between heads or switching from write to read, good data will be present at the interface within 20 μs.

c) Switching from not reading to reading, good data will be at the interface within 300 ns.

d) Switching from not writing or reading to writing, good data will be written within 300 ns

e) "Head Select" bit must be active 30 μs for the T-25/50/200 and 20 μs for the T-80/300 before the "Address Mark" bit.

TURN AC
POWER ON

TURN START
SWITCH ON

ISSUE
SEQUENCE

ISSUE
SELECT

RECEIVE
SELECTED

RECEIVE
ON-LINE?

NO

YES

RECEIVE
ATTENTION?

NO

YES

SEQUENCE
COMPLETE

RECEIVE
SEEK
INCOMPLETE?

NO

YES

ERROR CONDITION

REMOVE
SEQUENCE

POWER OFF
SEQUENCE

1 SEC DELAY

REMOVE
AC POWER
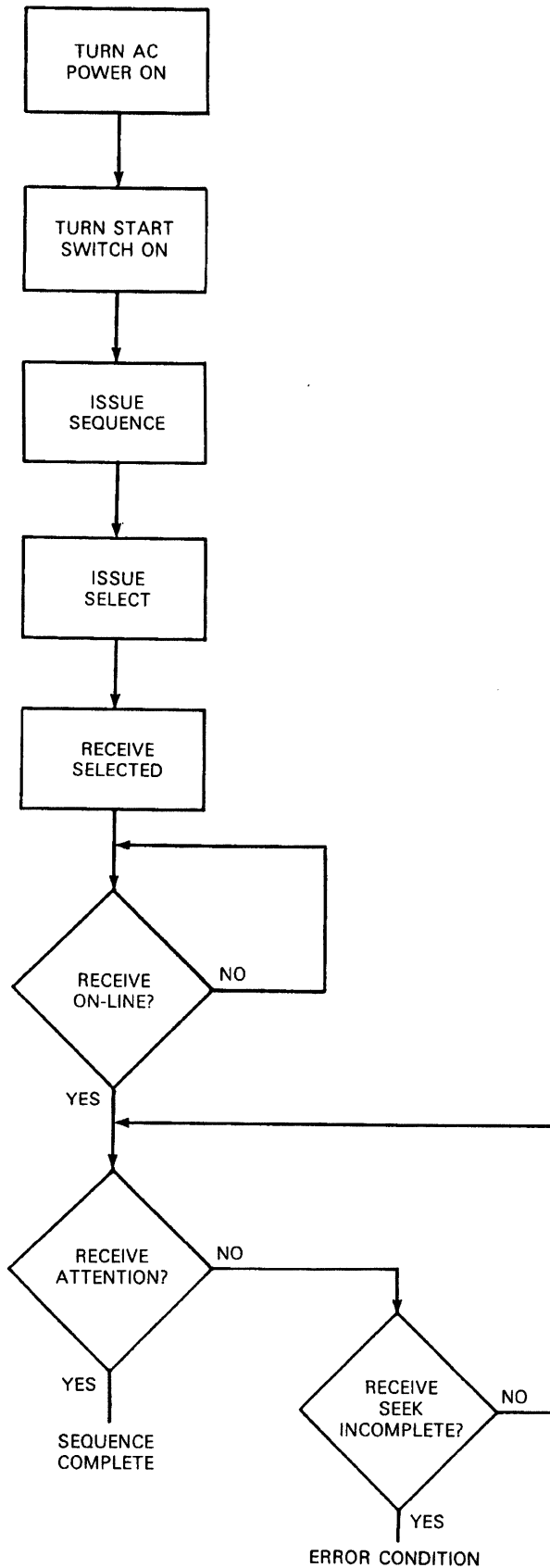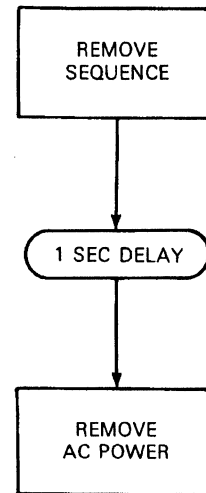
Figure 5-1. Power Sequence
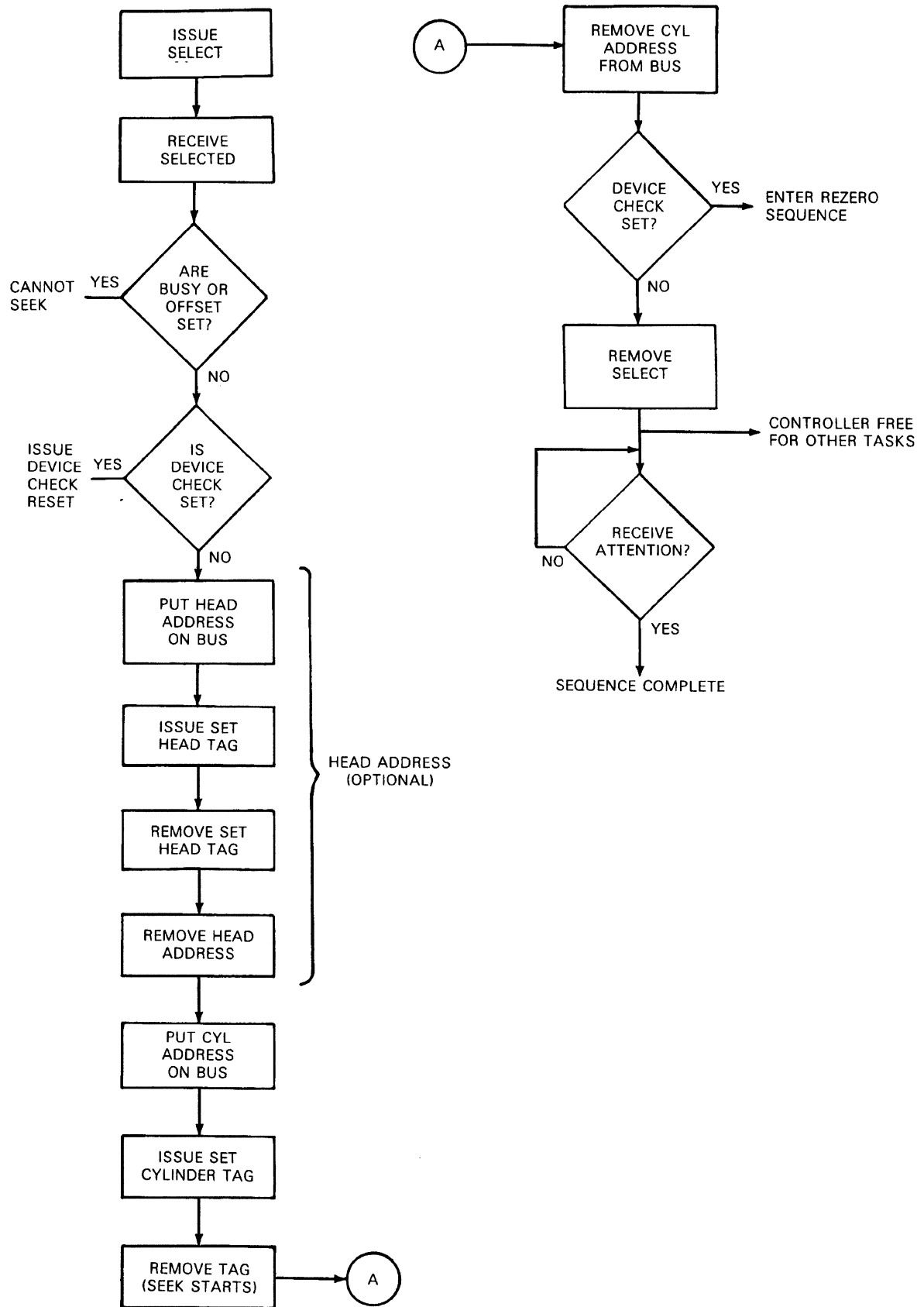
Figure 5-2. Seek Sequence
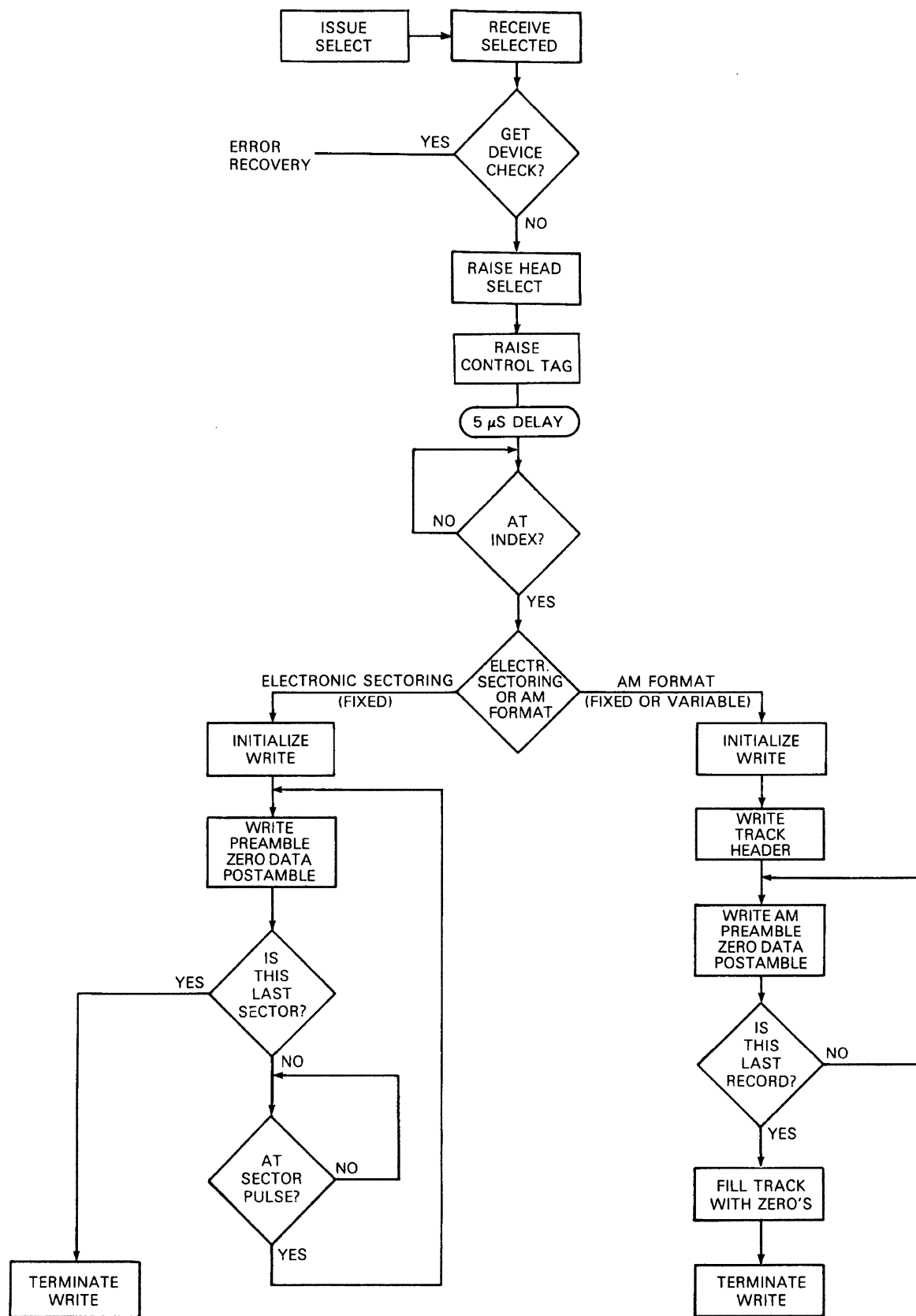
Figure 5-3. Track Initialization
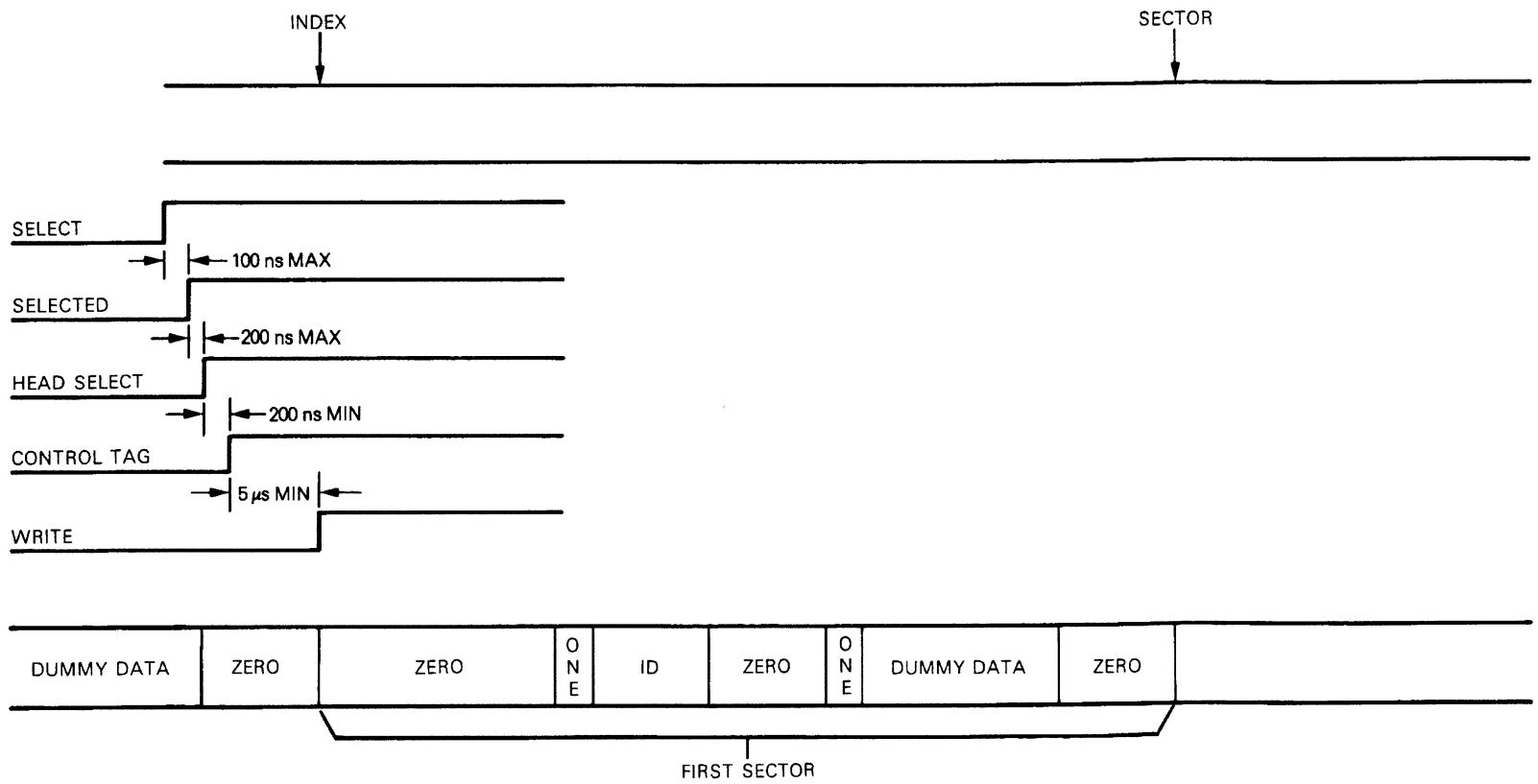
Figure 5-4. Initializing for Electronic Sectoring

INDEX

SECTOR

SELECT

100 ns MAX

SELECTED

200 ns MAX

HEAD SELECT

200 ns MIN

CONTROL TAG

5 μs MIN

WRITE

DUMMY DATA	ZERO	ZERO	O N E	ID	ZERO	O N E	DUMMY DATA	ZERO

FIRST SECTOR

Figure 5-5. Initializing for Address Mark Sectoring

INDEX

SELECT

|← 100 ns MIN

SELECTED

|← 200 ns MIN

HEAD SELECT

|← 200 ns MIN

CONTROL TAG

5 µs MIN

WRITE

ADDRESS MARK

7 ± 1 µs →|

DATA	ZERO	ZERO	ONE	TRACK ID	ZERO	ZERO	ONE	ID	ZERO	ONE	DATA	ZERO	

OPTIONAL TRACK HEADER
(ONCE PER TRACK)

FIRST SECTOR

```
ISSUE
SELECT
  │
  ▼
RECEIVE
SELECTED
  │
  ▼
GET
DEVICE ──YES──→ ERROR
CHECK?          RECOVERY
  │
  NO
  │
  ▼
WAIT FOR
SECTOR OR
INDEX MARK
  │
  ▼
RAISE HEAD
SELECT
  │
  ▼
RAISE CONTROL
TAG
  │
  ▼
*DELAY
  │
  ▼
RAISE READ
BIT
  │
  ▼
READ
SYNC ──NO──→ (loop back)
BYTE?
  │
  YES
  │
  ▼
READ
HEADER
  │
  ▼
DROP READ
BIT
  │
  ▼
IS
THIS
CORRECT ──NO──→ (loop back to WAIT FOR SECTOR OR INDEX MARK)
RECORD?
  │
  YES
  │
  ▼
  A
```

```
  A
  │
  ▼
RAISE
WRITE BIT
  │
  ▼
WRITE
ZERO PAD
  │
  ▼
WRITE
SYNC BYTE
  │
  ▼
WRITE
DATA
  │
  ▼
WRITE
ZERO PAD
  │
  ▼
DROP
WRITE
  │
  ▼
DROP CONTROL
TAG &
HEAD SELECT
```

*NOTE: T-25, T-50, T-200: 20 μs MIN
        T-80, T-300: 15 μs MIN

Figure 5-6. Write Using Electronic Sectoring

Figure 5-7. Write Using Electronic Sectoring (Format A)

SECTOR OR INDEX

SECTOR OR INDEX

PREAMBLE | VFO | SYNC | ID | VFO RELOCK | SYNC | DATA & CHECK | POSTAMBLE 1

SELECT

SELECTED

100 ns MAX

HEAD SELECT

200 ns MIN

200 ns MAX

CONTROL TAG

*SEE NOTE

READ

WRITE

400 ns MIN
4 μs MAX

1 BYTE

WRITE DATA

ZERO | ONE | DATA & CHECK | ZERO

*NOTE: T-25, T-50, T-200: 20 μs MIN
         T-80, T-300: 15 μs MIN
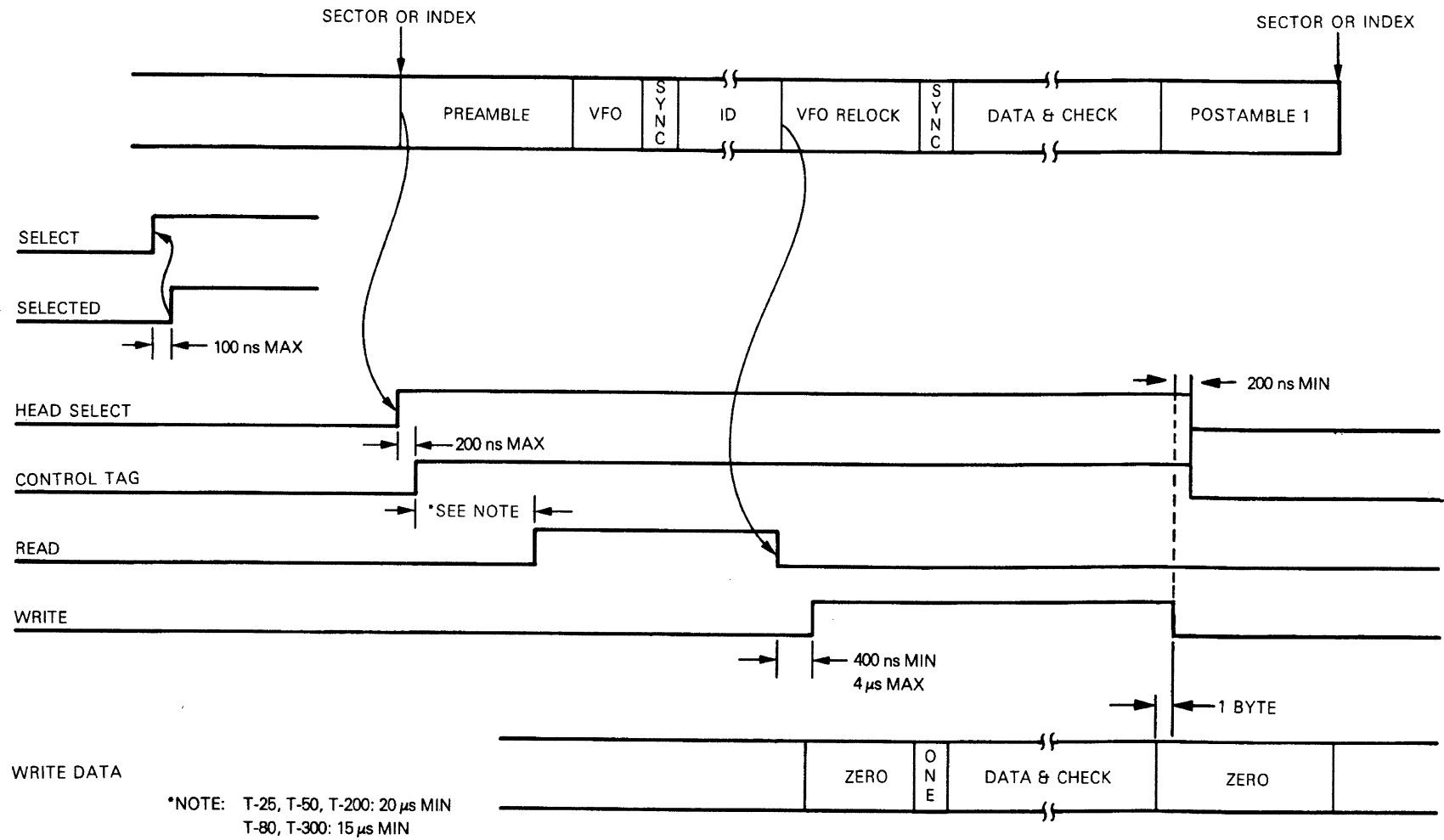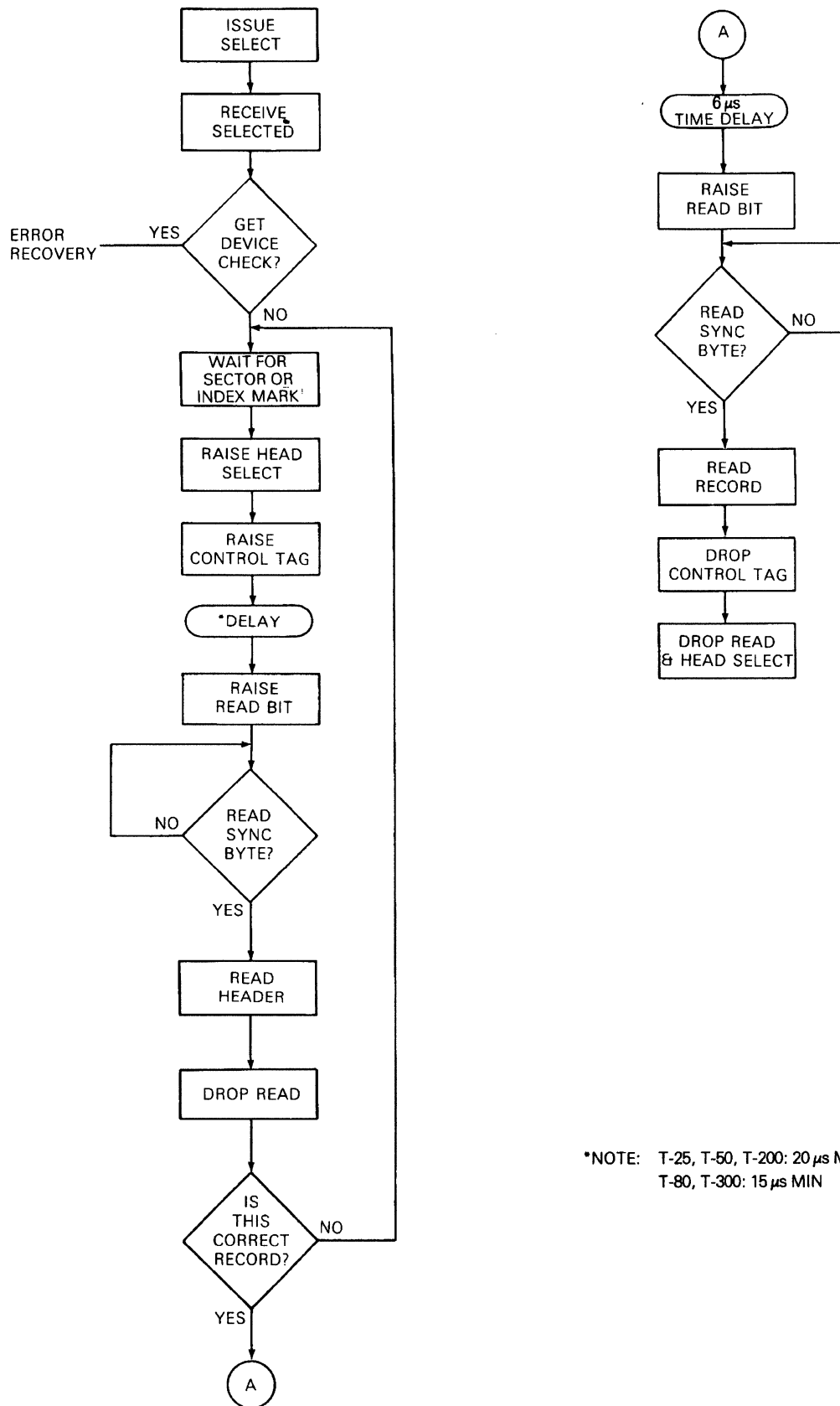
Figure 5-8. Read Electronic Sectoring

*NOTE: T-25, T-50, T-200: 20 μs MIN
             T-80, T-300: 15 μs MIN

Figure 5-9. Read Using Electronic Sectoring (Format A)

SECTOR OR INDEX

SECTOR OR INDEX

| PREAMBLE | VFO | S Y N C | ID | VFO RELOCK | S Y N C | DATA & CHECK | POSTAMBLE 1 |

SELECT

SELECTED

100 ns MAX

HEAD SELECT

200 ns MIN

200 ns MIN

CONTROL TAG

15us min

*SEE NOTE

READ

6 ± 0.7 μs

*NOTE: T-25, T-50, T-200: 20 μs MIN
T-80, T-300: 15 μs MIN
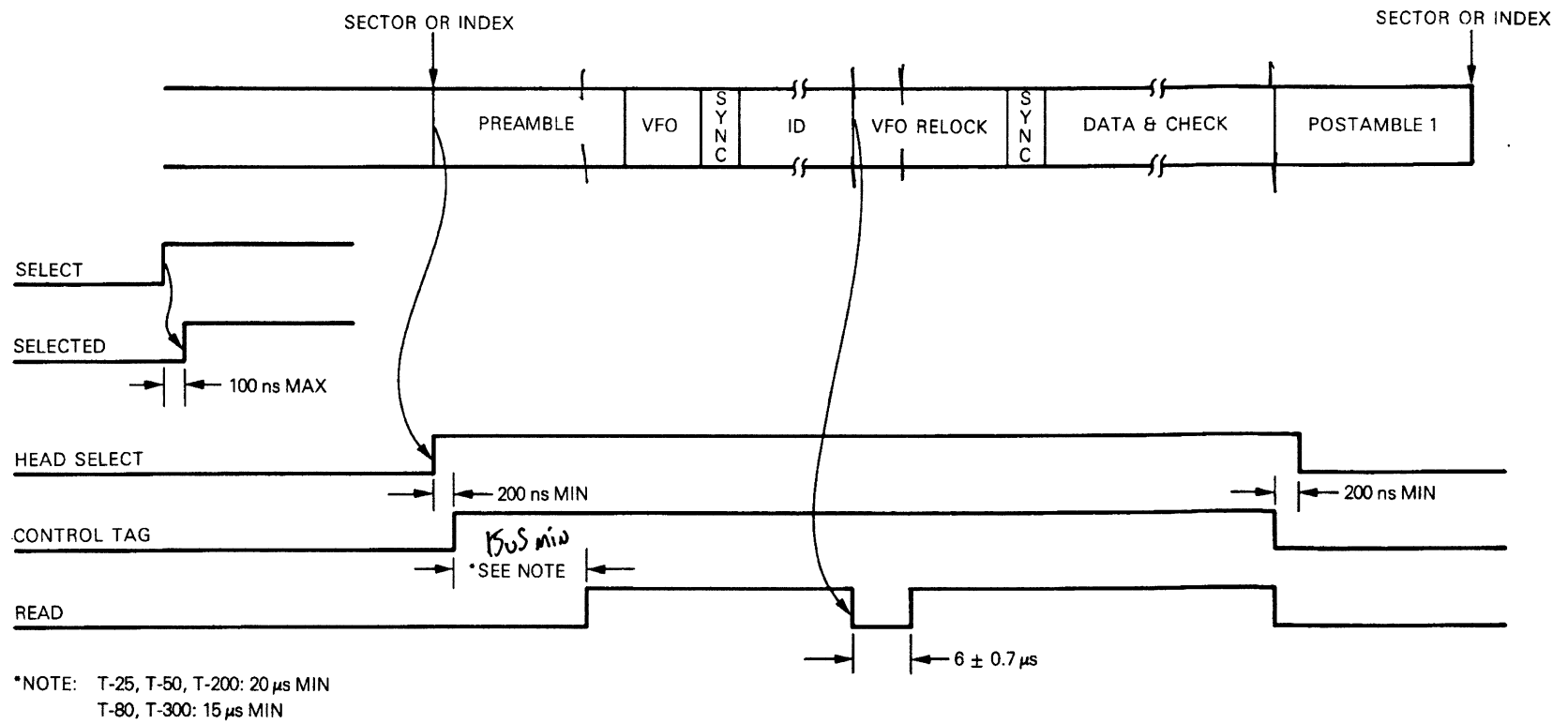
T80/300

Preamble	Zeros	40 Bytes
VFO	Zeros	8 Bytes
Sync	ones	1 bit min
ID	user def	opt
VFO Relock	Zeros	15 Bytes
Data/check	user def	opt
Postamble	Zeros	21 Bytes

ISSUE SELECT — RECEIVE SELECTED

GET DEVICE CHECK? — YES → ERROR RECOVERY

GET DEVICE CHECK? — NO → RAISE HEAD SELECT

RAISE CONTROL TAG

DELAY: NOTE 1

ISSUE READ BIT

DELAY: NOTE 2

ISSUE ADDRESS MARK BIT

GET ADDRESS MARK DETECTED? — NO (loop back)

GET ADDRESS MARK DETECTED? — YES → DROP ADDRESS MARK BIT

DETECT SYNC BYTE? — NO (loop back)

DETECT SYNC BYTE? — YES → READ HEADER → A

A → IS THIS CORRECT RECORD?

IS THIS CORRECT RECORD? — NO → (to DELAY: NOTE 2)

IS THIS CORRECT RECORD? — YES → DROP READ BIT

400 ns DELAY

RAISE WRITE BIT

WRITE VFO RELOCK

WRITE SYNC BYTE

WRITE DATA

WRITE ZERO PAD

DROP WRITE

DROP CONTROL TAG & HEAD SELECT

NOTE1:   T-25, T-50, T-200: 20 μs MIN
         T-80, T-300: 15 μs MIN
NOTE 2: T-25, T-50, T-200: 30 μs MIN
         T-80, T-300 20 μs MIN FROM CONTROL TAG

Figure 5-10. Write Using Address Marks

Figure 5-11. Write Using Address Mark Sectoring (Format C)

| AM | VFO | S Y N C | | ID | VFO RELOCK 1 | S Y N C | DATA & CHECK | | POSTAMBLE 2 | AM | VFO |

SELECT

100 ns MAX

SELECTED

200 ns MIN

HEAD SELECT

200 ns MIN

CONTROL TAG

SEE NOTE 1

READ

NOTE 1

SEE NOTE 2

400 ns MIN

NOTE 2

ADDRESS MARK

ADDRESS MARK DETECTED

1 BYTE NOMINAL

400 ns MIN, 4 µs MAX

WRITE

WRITE DATA

| | | ZERO | O N E | DATA & CHECK | | ZERO | |

(1 BYTE)

NOTE 1: T-25, T-50, T-200: 20 µs MIN
T-80, T-300: 15 µs MIN

NOTE 2: T-25, T-50, T-200: 30 µs MIN
T-80, T-300: 20 µs MIN
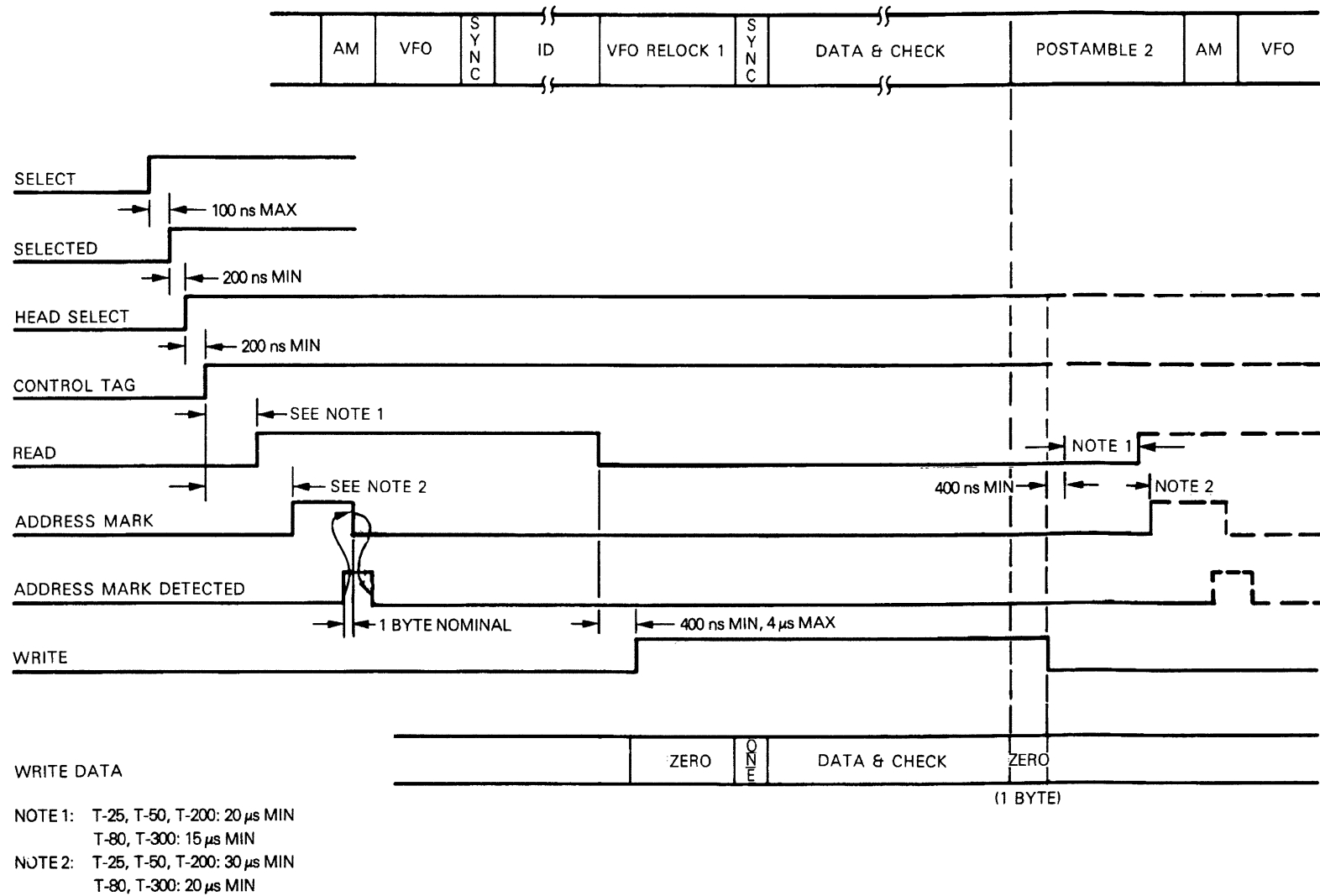
Figure 5.12. Write Using Address Mark Sectoring (Format E)
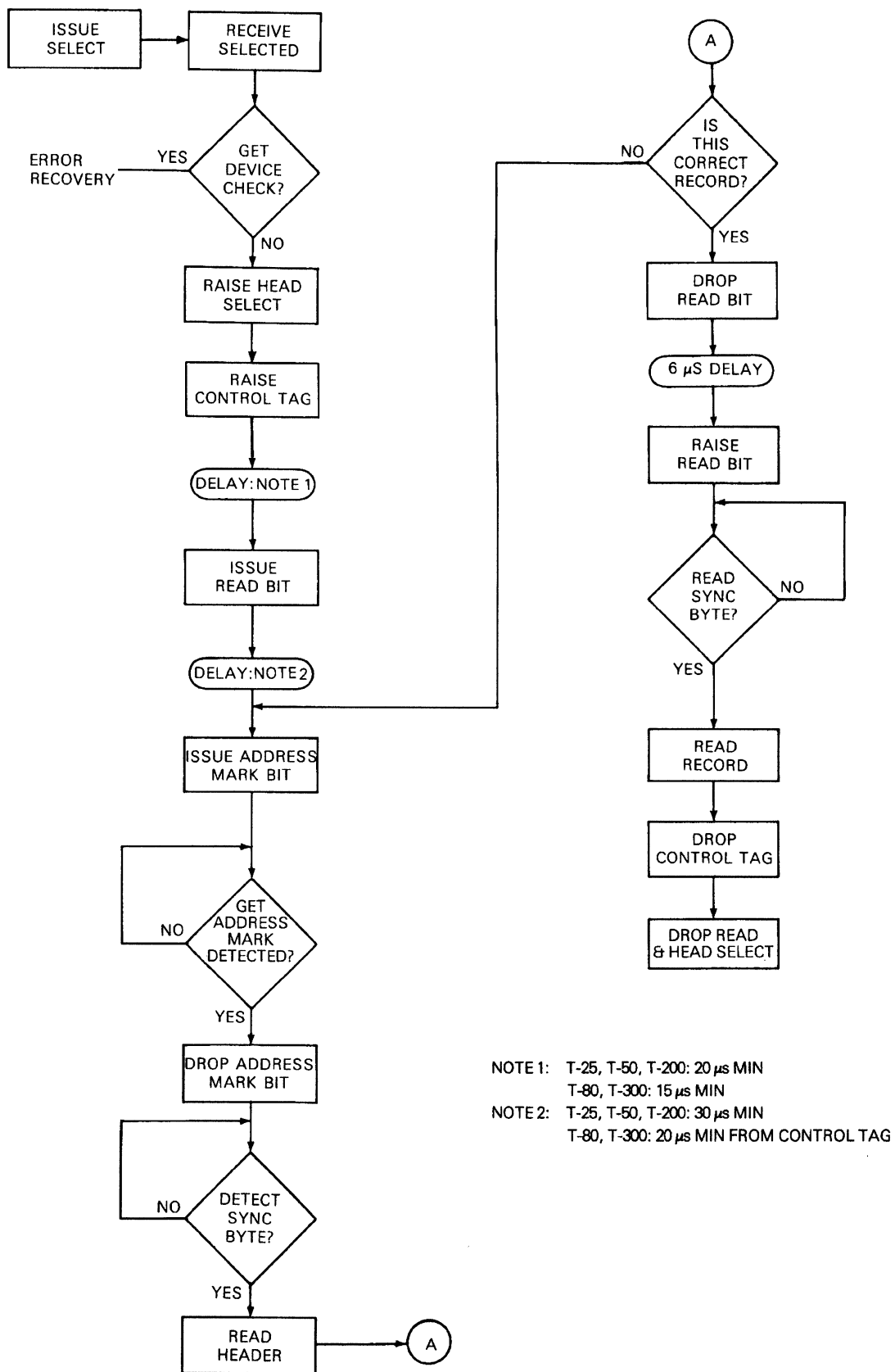
Figure 5-13. Read Using Address Marks

NOTE 1:   T-25, T-50, T-200: 20 μs MIN
          T-80, T-300: 15 μs MIN
NOTE 2:   T-25, T-50, T-200: 30 μs MIN
          T-80, T-300: 20 μs MIN FROM CONTROL TAG

Figure 5.14. Read Using Address Mark Sectoring (Format C)

NOTE 1:   T-25, T-50, T-200: 20 µs MIN
          T-80, T-300: 15 µs MIN
NOTE 2:   T-25, T-50, T-200: 30 µs MIN
          T-80, T-300: 20 µs MIN

Figure 5-14. Read Using Address Mark Sectoring (Format C)

	OFFSET REVERSE	ON TRACK	OFFSET FORWARD
EARLY STROBE	6 (2X)	2 (2X)	7 (2X)
NOMINAL STROBE	5 (2X)	1 (3X)	8 (2X)
LATE STROBE	4 (2X)	3 (2X)	9 (2X)

Figure 5-15. Error Recovery

SECTION 6
INTERFACE SIGNALS

6.1 ALL SIGNALS EXCEPT DATA AND CLOCK

Signal type	Single ended
High level	$5 \pm 0.5V$
Low level	$0.2 \pm 0.2V$
Rise and fall times	0-50 nS (10%-90% points)
Termination	100 ohms to +5V at both ends

6.2 READ/WRITE DATA AND CLOCK

Signal type Differential
Signal levels
  Output (as received at the users 100 ohm termination)
    High $+1.5V < V_{OH} < +2.0V$

    Low $0V < V_{OL} < +0.2V$
Input (as received from SN75112AJ line driver)
  High $0V < V_{IH} < +0.2V$

  Low $-0.8V < V_{IL} < -1.8V$

Logical states   logical 0 logical 1

R/W Clock or Data	high	low	(P line)
R/W Clock or Data	low	high	(M line)

Termination See figure 6.4.
Recommended Line Receivers
        Signetics NE527K
        Signetics NE529K
        National LM361H
Recommended Line Drivers
        Texas Instr. SN75112AJ
        (Ceramic only)
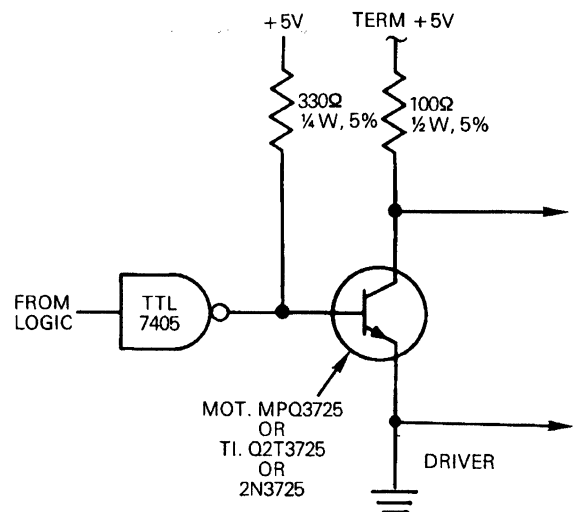
        Fairchild SN75112AJ
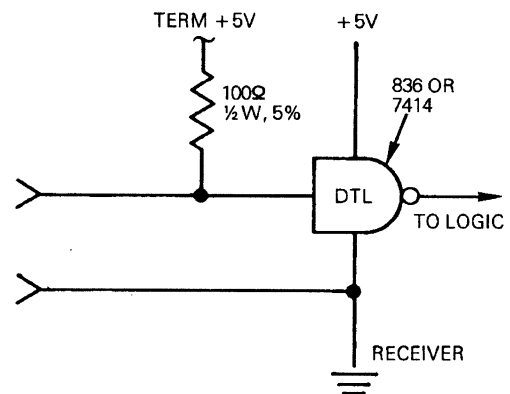   (Ceramic only)

Figure 6-1. Recommended Signal Line Driver
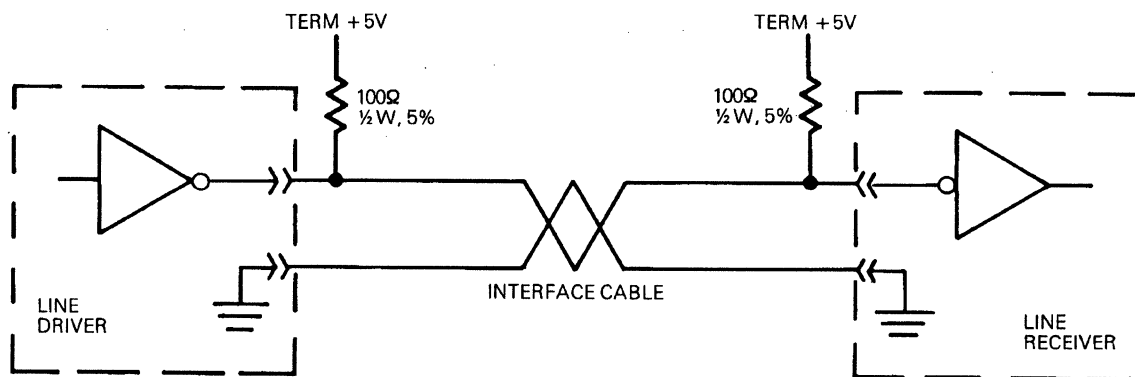

Figure 6-2. Recommended Signal Line Receiver

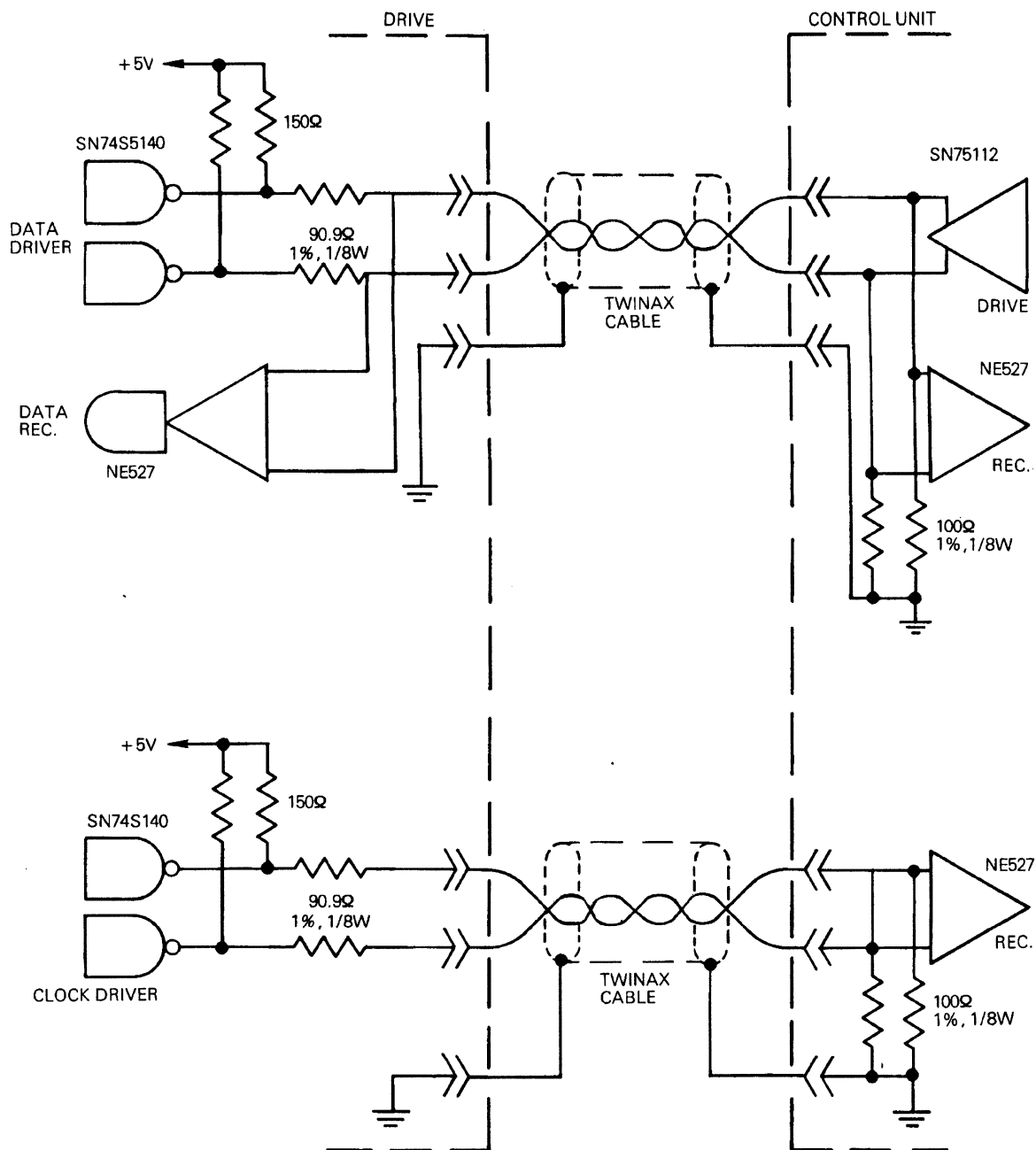**Figure 6-3. Drive-Controller Interface**

Figure 6-4. Recommended Read/Write Data and Clock Driver/Receiver

6.3 INTERFACE CABLES AND CONNECTORS

The Trident interface allows the use of different types of interconnecting cables. This section outlines the various possibilities and their respective requirements.

6.4 INTERFACE CABLE ASSEMBLIES AVAILABLE FROM CENTURY DATA SYSTEMS

P/N 19840-XXX, Radial Cable Assy. (6 ft. standard)

26 pin controller
mating connector: 3M 3429-2002
             ITT UND4B026D3D
             CDS 19535-001
P/N 19839-XXX, Bussed (Signal) Cable Assy., controller to first drive (6 ft. standard)

50 pin controller
mating connector: 3M 3433-2002
             ITT UND4B050D3D
             CDS 16446-001
P/N 19841-XXX, Bussed (Signal) Cable Assy., drive to drive (6 ft. standard)
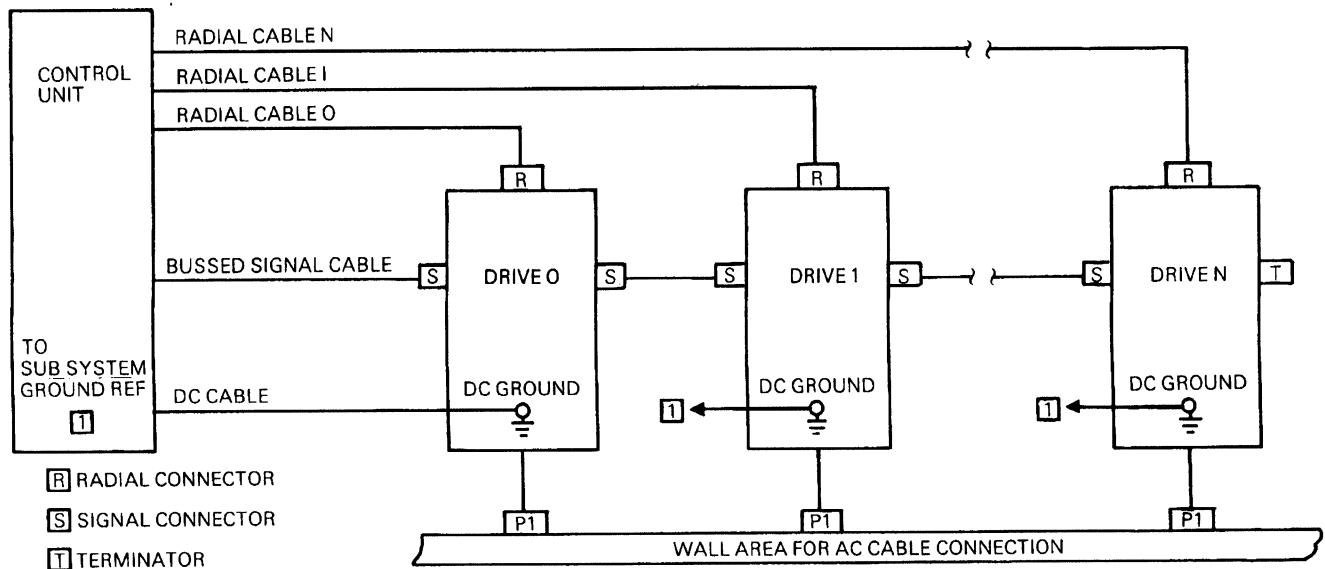
P/N 19318-001, ☐ Terminator

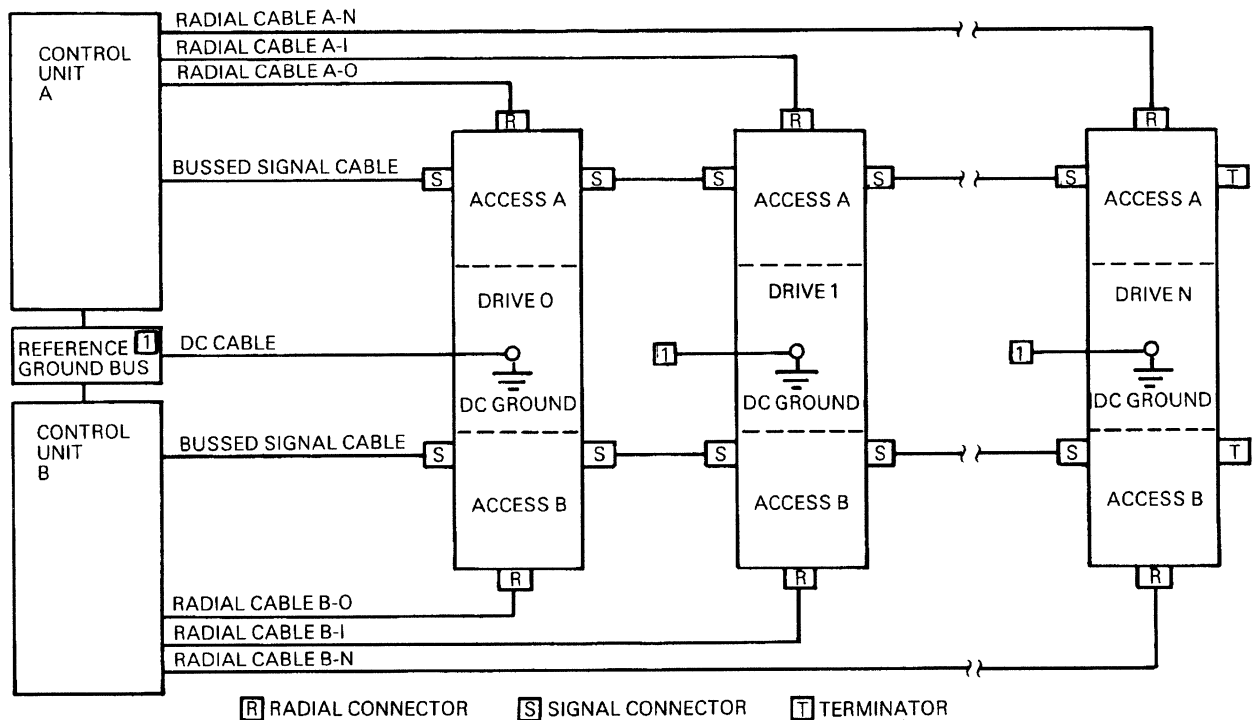**Figure 6-5. Single Access Cabling, Daisy Chain Configuration**

Figure 6-6. Dual Access Cabling, Daisy Chain Configuration

Note: The 3-digit dash number determines the cable length in feet. The maximum individual cable is 50 ft. (15m). The maximum bus cable length (cumulative) is limited to 70 ft. (21m).

The following sections define cable specifications and connector pin assignments for customers who wish to build their own interface cables.

6.4.1 Bussed Cable (Signal Cable)

There are three recommended methods of building the Bussed Cable:

1. Twisted Pair Flat Cable (20 pairs)

   Impedance 85Ω ±10%

6-3

Table 6-1. Bussed Cable Pin Numbers

PIN NO.	SIGNAL	PIN NO.	SIGNAL
01	SECTOR	21	GROUND
02	END OF CYLINDER	22	BUS 1
03	ADDMKDET	23	GROUND
04	OFFSET	24	BUS 2
05	TERMINATOR +5V	25	GROUND
06	INDEX	26	BUS 3
07	TERMINATOR +5V	27	GROUND
08	READY	28	BUS 4
09	GROUND	29	GROUND
10	RDONLY	30	BUS 5
11	GROUND	31	GROUND
12	DEVICE CHECK	32	BUS 6
13	GROUND	33	GROUND
14	ONLINE	34	BUS 7
15	GROUND	35	TERMINATOR IN
16	SEEK INCOMPLETE	36	BUS 8
17	GROUND	37	CONTROLTAG
18	SPARE	38	BUS 9
19	GROUND	39	SETCYLTAG
20	BUS 0	40	SETHDTAG

24 AWG — max. cable length (cumulative) 100 ft. (30m)

CDS cable P/N 90878-420

Cable manufacturers — Woven Electronics
Brand Rex
Ribbon Cable

Connectors required —
[S] CDS P/N 19535-001, Signal Connector

[T] CDS P/N 19318-001, Terminator

2. Twist 'n' Flat Cable (25 pairs)

Impedance 105Ω

28 AWG — max. cable length (cumulative) 70 ft. (21m)

Cable manufacturer — Spectra Strip, P/N 455-248-50

Connectors required —
Flat cable adapter, CDS P/N 19205-002

50 pin cable connector, Spectra Strip P/N 802-150

3. Flat Ribbon Cable (25 pairs)

Impedance 105Ω

28 AWG — max. cable length (cumulative) 70 ft. (21m)

CDS cable P/N 19153-050

Cable Manufacturers — 3M, P/N 3365/50
Brand Rex, P/N TC1008/50

Connectors required —
[S] CDS P/N 19829-001, Ribbon Cable Adapter

Cable connector, 50 pin, CalComp P/N 17265-001 — 3M P/N 34265-0000T

[T] CDS P/N 19318-001, Terminator

6.4.2 Radial Cable

There are two recommended methods of building the Radial Cable:

1. Twisted Pair Flat Cable plus TWINAX

   Twisted Pair Flat Cable (13 pairs), all signals except Clock and Read/Write Data

   Impedance 85Ω ±10%

   24 AWG — max. cable length 100 ft. (30m)

   CDS cable P/N 90878-414

   Cable manufacturers — Woven Electronics
   Brand Rex
   Ribbon Cable

   TWINAX (Clock, Read/Write Data)

   Impedance 200Ω ±5% line to line (differential)

   100Ω ±10% each line to shield (common mode)

   Max. cable length 100 ft. (30m)

   CDS cable P/N 11593-001

   Cable manufacturer —
   Brand Rex, P/N T5780A

   Connectors required —
   [R] CDS P/N 16446-001, Radial Cable Connector

2. Flat Ribbon Cable (13 pairs), all signals

   Impedance 105Ω

   28 AWG — max. cable length 50 ft. (15m)

   CDS cable P/N 19706-026

   Cable Connector, 26 pin, 3M P/N 3434-0000T

   Connectors required —
   [R] CDS P/N 19687-001, Radial/Flat cable adapter, drive side

   Cable connector, 26 pin, 3M P/N 3434-0000T

   CDS P/N 19685-001, Radial/Flat cable adapter, controller side

   Cable connector, 26 pin, 3M P/N 3434-0000T

6.5 GROUNDING

AC-chassis ground is electrically isolated from DC-ground within each drive. A DC-ground stud to accept a #8-14 AWG wire is provided on the isolated DC-ground for subsystem interconnection. This ground connection with the controller is mandatory for proper operation.

Table 6-2. Radial Cable Pin Numbers (Single or Dual Access)

SIGNAL PIN	SIGNAL FUNCTION	SIGNAL PIN	SIGNAL FUNCTION
01	GROUND	23	GROUND
02	GROUND	24	COMPOSITE
03	GROUND		SECTOR INDEX
04	REQUEST	25	GROUND
05	GROUND	26	ATTENTION
06	REQUEST	27	GROUND
	(FROM OTHER C.U.)	28	MODULE Selected
07	GROUND	29	GROUND
08	NOT USED	30	SEQUENCE
09	GROUND	31	GROUND
10	NOT USED	32	MODULE SELECT
11	GROUND	33	GROUND
12	NOT USED	34	READ/WRITE DATA (P)
13	GROUND		
14	NOT USED	35	GROUND
15	GROUND	36	READ/WRITE DATA (M)
16	NOT USED		
17	GROUND	37	GROUND
18	NOT USED	38	READ/WRITE CLOCK (P)
19	NOT AVAILABLE		
20	NOT AVAILABLE	39	GROUND
21	TERMINATOR −5V	40	READ/WRITE CLOCK (M)
22	TERMINATOR −5V		

Table 6-3. Radial Cable Pin Numbers (Single Access Only)

PIN NO.	SIGNAL	PIN NO.	SIGNAL
01	TERMINATOR +5V	11	GROUND
02	TERMINATOR +5V	12	SELECT
03	GROUND	13	GROUND
04	COMPSECIDX	14	R/W DATA P
05	GROUND	15	GROUND
06	ATTENTION	16	R/W DATA M
07	GROUND	17	GROUND
08	SELECTED	18	R/W CLOCK P
09	GROUND	19	GROUND
10	SEQUENCE	20	R/W CLOCK M

SECTION 7
CONTROLS AND INDICATORS

7.1 FRONT PANEL

7.1.1 Start

This toggle switch controls power to the spindle motor only. All internal power supplies are energized even when this switch is off.

7.1.2 Read Only

Placing the toggle switch in the Read Only position will inhibit any writing on the pack. The inhibit is activated and released only when the drive is not selected, or rezero is active.

7.1.3 Device Check

This indicator is lit whenever an internal failure or control error is detected. It is reset by the Device Check Reset I/O Command.

7.1.4 Ready

This indicator is off when the drive is not ready. It blinks during the power-up or power-down sequences and is on when the drive is ready to accept commands from the controller.

7.2 ACCESS A ENABLE (OPTIONAL)

In the up position, access A of the dual access feature is enabled. The logical state changes only when a tag is not active.

7.3 ACCESS B ENABLE (OPTIONAL)

In the up position access B of the dual access feature is enabled. The logical state changes only when a tag is not active.

7.4 REAR PANEL/INTERNAL

7.4.1 AC Power

The power to the entire Trident disk drive is controlled by a toggle switch or a circuit breaker.

7.4.2 Degate Switch

This toggle switch is PC card mounted. In the ONLINE position, the controller interface is enabled and the exerciser interface is disabled. In the OFFLINE position the controller is disabled and the exerciser is enabled. If it is placed in the degate position prior to power-up or power-down, transient signals do not disturb any other TRIDENT on the same controller bus. The monitoring capabilities of the exerciser are active in either position.

7.4.3 Sector Count Selection

Two IC sockets are wired to accept jumpers coded to select sector count information.

7.5 DC GROUND SEPARATION

DC ground and the frame can be isolated or connected together with a jumper (T-25/50/80) or a toggle switch (T-200/300).

7.6 DUAL ACCESS FAILSAFE TIMER

Jumper sockets are located on the Dual Access electronics to allow a change of the nominal 10 sec timeout.

T-25/50/80:

Minimum timeout: 650 ms
Maximum timeout: 39 sec
Timer can be changed in 650 ms, 1.3 sec and 2.6 sec steps.

T-200/300:

Minimum timeout: 1.3 sec
Maximum timeout: 19.5 sec
Timer can be changed in 1.3 sec steps

SECTION 8
ENVIRONMENTAL CHARACTERISTICS

8.1 GENERAL

The diskpack and disk drive shall be subjected to the same environmental conditions for at least two hours before the disk pack is to be installed and used in the disk drive.

8.2 TEMPERATURE

Equipment Operational:	60°F to 100°F (16°C to 38°C) with a max. gradient of 20°F (11°C) per hour.
Equipment Non-operational:	−40°F to 150°F (−40°C to 66°C)
Temperature Cycling:	No condensation shall result.

8.3 HUMIDITY

Equipment Operational:	10% to 80% R.H., with a wet bulb temp. limit of 75°F (24°C) provided there is no condensation.
Equipment Non-operational:	5° to 80° R.H., provided there is no condensation.

8.4 ALTITUDE

Equipment Operational:	Sea level to 7000 feet (2100m).
Equipment Non-operational:	From 1,000 feet below sea level to 40,000 feet above sea (−300m to 12000m)

8.5 HEAT DISSIPATION

T-25/50/80: 2500 BTU/hr
T-200/300: 3500 BTU/hr

8.6 AIR FLOW:

T-25/50/80:
100 CFM (2.8m³/min), min. at 60 Hz
 83 CFM (2.3m³/min), min. at 50 Hz

T-200/300:
200 CFM (6m³/min), min. at 60 Hz
167 CFM (5m³/min), min. at 50 Hz

8.7 VIBRATION

Equipment Operational:	The equipment shall withstand a peak displacement of ±0.006 in. (0.15 mm) for the frequency range of 5 Hz to 60 Hz and ±1g for the 60 Hz to 500 Hz range.
Equipment Non-operational:	The equipment, without internal bracing and/or external packaging, shall withstand ±1.5g from 5 Hz to 55 Hz for one hour along each of three mutually perpendicular axes, with a 20 minute sweep time. (Except heads must be held retracted as for shipping.)

8.8 SHOCK

The equipment in non-operational status shall not suffer damage or fail to operate according to specifications, when subjected to 18 impact shocks of 5g (±10%) consisting of 3 shocks along each direction of three mutually perpendicular axes. Each shock impulse shall be a half sine wave with a time duration of 11 ± 1 ms.

8.9 DUST CONTROL

The disk drive is equipped with air filters to ensure the circulation of clean air through the disk drive. All air filtration and air moving mechanisms are completely within the assembly. The pack area is completely closed while the disk drive is operational except for designated air entrance and exit channels. Care should be taken to keep dust and dirt exposure via the service/pack area openings to a minimum.

SECTION 9
POWER REQUIREMENTS

9.1 AC POWER

Table 9-1. AC Power

T-25, T-50 and T-80				
Voltage	**Frequency**	**Phasing**	**Run**	**Start (8 sec)**
100-127 VAC, + 10%, − 15%	60 Hz ± 1%	Line to Neutral	7.5A	24A
100-127 VAC, + 10%, − 15%	50 Hz ± 1%	Line to Neutral	7.5A	24A
190-240 VAC, + 10%, − 15%	60 Hz ± 1%	Line to Neutral	4.5A	13A
190-240 VAC, + 10%, − 15%	50 Hz ± 1%	Line to Neutral	4.5A	13A
190-240 VAC, + 10%, − 15%	60 Hz ± 1%	Line to Line	4.5A	13A
190-240 VAC, + 10%, − 15%	50 Hz ± 1%	Line to Line	4.5A	13A
T-200 and T-300				
Voltage	**Frequency**	**Phasing**	**Run**	**Start (10 sec)**
208-240 VAC, + 10%, − 15%	60 Hz ± 1%	Line to Neutral and L/L	5A	25A
208-240 VAC, + 10%, − 15%	50 Hz ± 1%	Line to Neutral and L/L	5A	25A

9.2 DC POWER

Internally generated.

9.3 TERMINATOR POWER

+5 VDC, ±5% (measured at the terminator),
150 mA, + 1.25A max., −0A.

SECTION 10
PHYSICAL CHARACTERISTICS

Height: 10.4 inches (264 mm)
Width: 17.5 inches (444 mm)
Depth: 32.0 inches (813 mm)
Weight: Operating 220 lbs (100 kg)
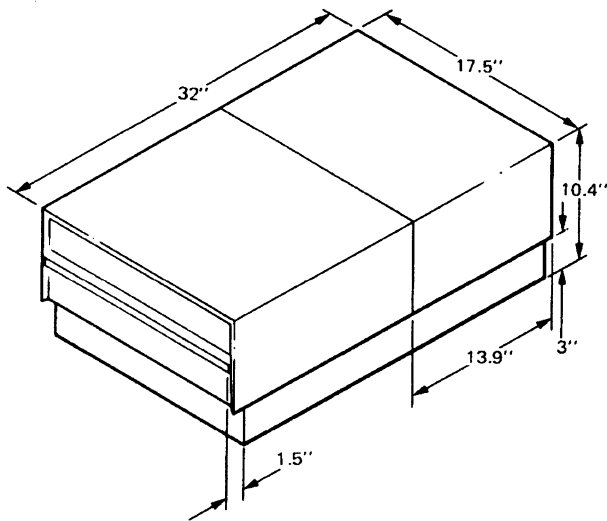   Shipping 285 lbs (129 kg)

Height: 36.0 inches (914 mm)
Width: 19.5 inches (495 mm)
Depth: 33.0 inches (838 mm)
Weight: Operating 480 lbs (217 kg)
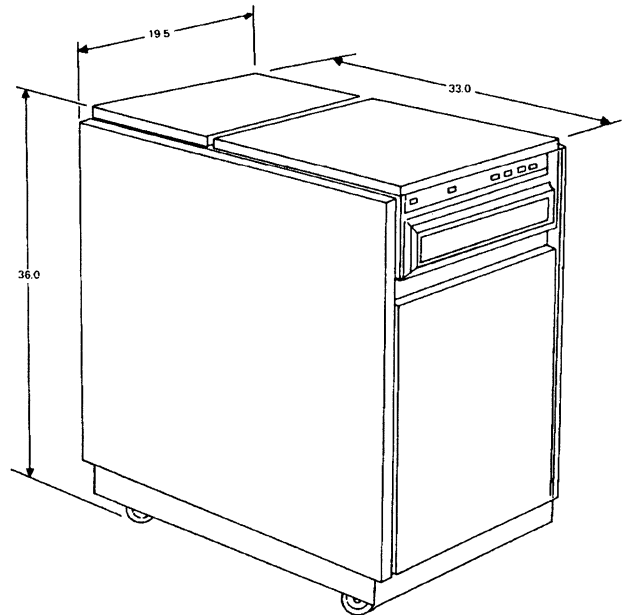   Shipping 525 lbs (238 kg)

Figure 10-1. T-25/50/80 Outline Dimensions

Figure 10-2. T-200/300 Outline Dimensions